

# WEST END LIBRARY

## PROJECT NOTIFICATION FORM

Submitted To: **Boston Planning & Development Agency (BPDA)**  
One City Hall Square, 9<sup>th</sup> Floor, Boston, MA 02201

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In Association With: **MASS Design Group**  
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**G2 Collaborative**  
**Goulston & Storrs PC**  
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**Vanasse Hangen Brustlin, Inc. (VHB)**  
**Acentech, Inc.**  
**Samiotes Consultants, Inc.**  
**Nitsch Engineering**  
**McPhail Associates LLC**  
**Epsilon Associates**  
**Rowan Williams Davies & Irwin, Inc (RWDI)**  
**EnviENERGY Studio**  
**CLEAResult**  
**Bartlett Tree Experts**  
**Consigli Construction**

Submission Date:

January 7, 2025



January 7, 2025

Teresa Polhemus  
Executive Director/Secretary  
Boston Planning & Development Agency  
One City Hall Square  
Boston, Massachusetts, 02201

**Re: 151 Cambridge Street - West End Library Redevelopment Project Notification Form**

Dear Director Polhemus,

In accordance with the Executive Order Relative to the Provision of Mitigation by Development Projects in Boston issued on October 10, 2000, as amended on April 3, 2001, Preservation of Affordable Housing, Inc. ("POAH") and Caste Capital, LLC ("Caste") hereby submit the attached Project Notification Form ("PNF") under Article 80B of the Boston Zoning Code (the "Code") for the West End Library Project (the "Project"). This proposed mixed-use development, located at 151 Cambridge Street in Boston's West End, represents a significant step toward addressing the City of Boston's housing and community resource needs.

The transformative development will replace the existing library with a new mixed-use building of approximately 176,000 square feet. Featuring a 12-story residential building above a two-story public library. The Project will create 119 units of affordable housing, all reserved for households earning below an 80% area median income (AMI). This includes 40 subsidized units; 32 Project Based Voucher (PBV) units through the Faircloth-to-RAD program and 8 units through the Massachusetts Rental Voucher Program (MRVP). The Project will provide essential housing opportunities for some of Boston's lowest-income families in a neighborhood with strong economic potential, close to transit, grocery stores, healthcare facilities, and other essential services.

The Project's impact extends beyond housing. It is designed to strengthen the urban and social fabric of the community while breathing new life into a cherished public resource. The Project will feature a robust resident service program, tailored to foster an inclusive environment and encourage residents to connect with each other. The revitalized approximately 19,000 square foot library will serve as a vibrant hub for social interaction, learning, and cultural engagement, while the new outdoor plaza between the Otis House and library will create additional opportunities for community gatherings. The open and shared space will not only increase the library's visibility but also build stronger ties to nearby cultural resources, showcasing its newfound role as a vital public asset that was once hidden.

The development plan also aligns with the City's goals by promoting a diverse construction workforce and incorporating sustainable, innovative construction methods to reduce its environmental impact. The building will be designed and constructed with a high-performance envelope and MEP systems to meet the Passive House (PHIUS) standard requirements. Furthermore, POAH and Caste are committed to providing

contract opportunities for Minority and Women-Owned Business Enterprises (M/WBEs). We will work with the selected general contractor and subcontractors during pre-construction and construction to ensure that the Project will not only achieve the City's goals but exceed them.


The West End Library redevelopment will be a transformative project for the neighborhood of the West End. By seamlessly blending affordable housing, public resources, and thoughtfully designed spaces, the project will enhance neighborhood connectivity and foster a sense of belonging for all residents, regardless of income or background. We look forward to your review.

Sincerely,



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Meena Jacob  
Preservation of Affordable Housing  
VP, Real Estate Development



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Patrick Kimble  
Caste Capital, LLC  
Founder and Managing Partner

cc: Beverley Johnson – Article 80 Consultant, Bevco, Inc.  
Rodger Brown – Managing Director, POAH  
Camille Platt – Project Manager, BPDA  
Joseph Backer – Senior Development Officer, MOH

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## **1. Project Description**

### **1.1 Introduction**

In April 2023, the City of Boston Public Facilities Commission (PFC) issued a Request for Proposals (RFP) for the redevelopment of the West End Branch of the Boston Public Library (BPL) located at 151 Cambridge Street in the West End neighborhood of Boston. The site consists of approximately 0.51 acres of land bounded to the south by Cambridge Street, to the west and north by property owned by Massachusetts General Hospital and utilized as part of the Charles River Plaza, and to the east by property on which the Otis House is located (the "Project Site"). The PFC received several proposals for the redevelopment, and in December 2023 the PFC, in close coordination with BPL and the Mayor's Office of Housing, selected Preservation of Affordable Housing, Inc. and Caste Capital, LLC (together, the "Proponent") to lead the redevelopment efforts.

The Proponent is pleased to submit this Project Notification Form (PNF) to initiate Large Project Review by the Boston Redevelopment Authority, d/b/a/ Boston Planning & Development Agency (BPDA), under Article 80B of the Boston Zoning Code (the "Code"). This PNF outlines a plan for the redevelopment of the Project Site into a mixed-use building comprised of a new, two-story branch library and approximately 119 income-restricted rental residential units within 12 additional stories (the "Proposed Project").

This chapter introduces the Proposed Project and provides an overview of the existing conditions at the Project Site. This chapter also summarizes the Proposed Project's anticipated public benefits and describes the Proponent's community outreach to date.

## **1.2 Existing Site and Area Context**

The approximately 0.51-acre Project Site is located at 151 Cambridge Street in the West End neighborhood of Boston. An existing conditions plan is provided in [Figure 1-1](#) below. The Project Site is improved by an existing one-story building containing approximately 7,240<sup>1</sup> square feet of gross floor area, which currently serves as the West End Branch of the BPL.

The West End is a vibrant, mixed-use neighborhood, and the area where the Proposed Project will be located is undergoing significant economic and physical revitalization. The Proposed Project will complement several other proposed developments which are focused on improving public infrastructure and commercial spaces.

## **1.3 Proposed Project**

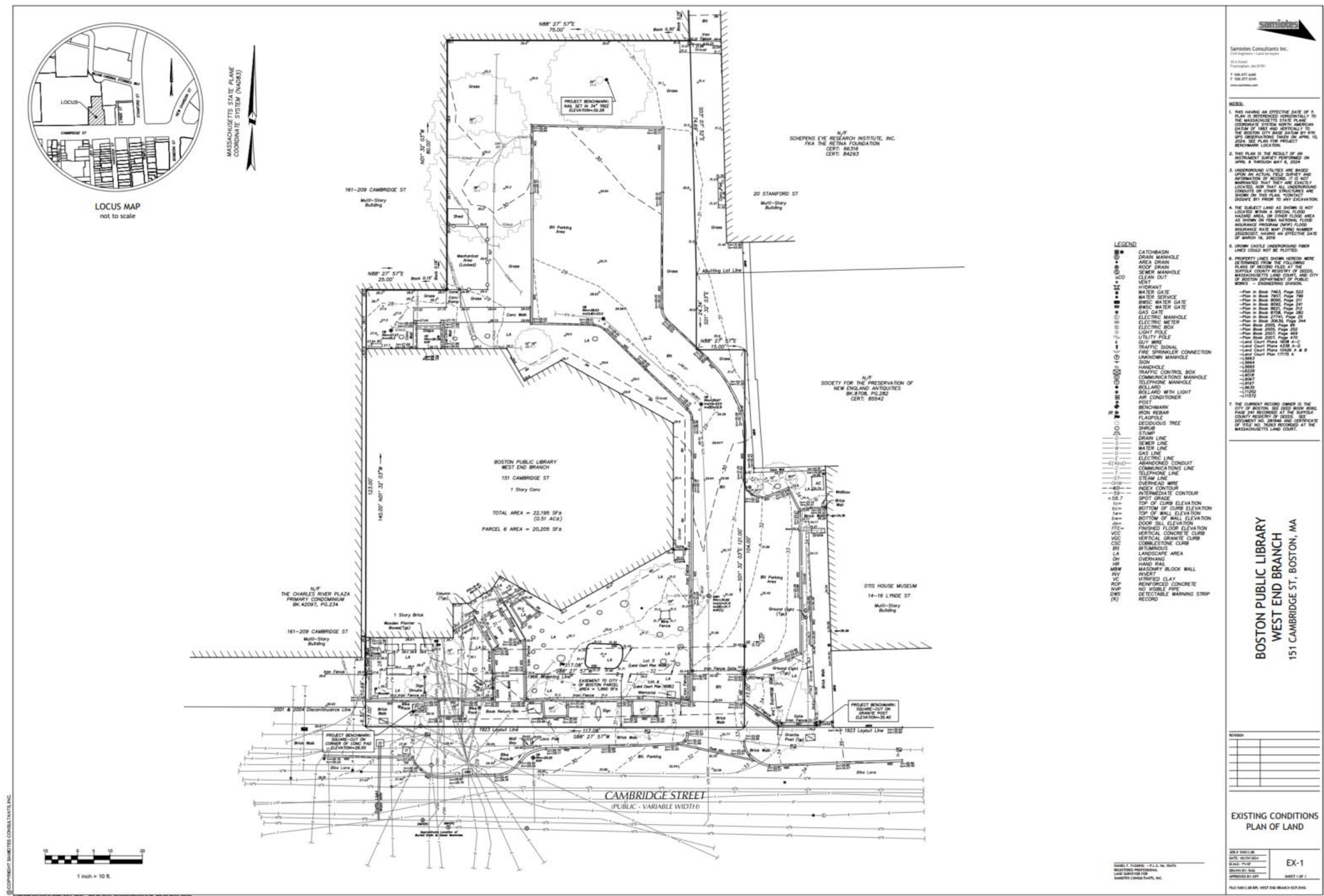
The Proponent proposes to demolish the existing library building and construct a new mixed-use building of approximately 176,520 square feet, comprised of a new, two-story branch library and approximately 119 income-restricted rental residential units across 12 additional stories. The residential unit mix will range from studio to three-bedroom apartments, with units available for families, seniors and individuals earning less than 80% of area median income (AMI), providing affordable housing in a neighborhood with strong economic potential and in close proximity to public transit, healthcare facilities, grocery stores, and other essential amenities. The new, two-story branch library will be more than double the size of the current branch library, and the design of the space will be informed by community feedback gathered during a comprehensive programming study carried out by the BPL in 2020 and 2021.

In addition to a new mixed-use building, the Proposed Project includes an outdoor plaza and shared community amenities designed for library visitors, residents, and the public. These features will serve as a valuable new neighborhood amenity that will help strengthen connections to nearby cultural resources and increase the library's visibility.

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<sup>1</sup> The GSF applies only to the existing library building footprint and does not include the 2,887 SF of the basement floor.

Figure 1-1 Existing Conditions Plan



The Proposed Project will not provide any on-site vehicle parking spaces, but it will provide up to approximately 160 bicycle parking spaces. The Proponent has held discussions with Historic New England (HNE), the owner of the Otis House, and has confirmed that HNE is amenable to the removal of the existing surface parking to establish an enhanced public realm between the Project Site and the Otis House. The Proponent will continue to collaborate with HNE to coordinate this matter. As noted above, the Project Site is located near several MBTA subway lines, including the MBTA Blue, Red, Green, and Orange Lines, which will provide convenient transit options for residents and facilitate access for library visitors.

[Table 1.1](#) below provides a summary of the key elements of the Proposed Project.

**Table 1-1 West End Library Development Program**

Development Components	Approximate Dimensions
Proposed Lot Area	22,195 SF
Gross Floor Area <sup>1</sup>	176,520 SF
Floor Area Ratio	7.95
No. of Floors	14
Building Height	165'-0"
No. of Residential Units	119
Community Use Space (Library)	19,000 SF
Vehicle Parking	None provided
Bicycle Parking	128 long-term storage spaces 32 short-term storage spaces

<sup>1</sup> Includes total gross floor area of library and residential component.

## 1.4 **Summary of Public and Community Benefits**

### 1.4.1 **Public Benefits**

#### **Project Affordability**

The Proposed Project will support the City's housing goals by providing approximately 119 new rental units for households earning 80% or less of AMI in an area that, while rich in resources, is experiencing a critical shortage of affordable housing. The development will offer housing opportunities to some of Boston's lowest-income families in a neighborhood with strong

economic potential, with convenient accessibility to public transit, grocery stores, healthcare facilities, and other essential services.

A breakdown of the Proposed Project's affordability program is provided in [Table 1-2](#) below.

**Table 1-2 West End Library Affordability Program**

<b>Affordable to Households at:</b>	<b>Units</b>	<b>% of Total</b>
30% AMI	40	34%
60% AMI	49	41%
80% AMI	30	25%
<b>Total</b>	<b>119</b>	<b>100%</b>

### **Transit-Oriented Development**

The Project Site is located near several MBTA subway stations, including Bowdoin (Blue Line) located just 0.1 miles away, Charles/MGH (Red Line) and Government Center (Green and Blue Lines) both located 0.3 miles away, and Haymarket (Orange and Green Lines) located 0.4 miles away. Additionally, bike-share and ride-share options are easily accessible. The Proposed Project will not create any new on-site parking, but adequate bicycle parking will be provided, promoting greater reliance on public transportation. This approach will help reduce residents' dependence on cars, contributing to a decrease in local congestion and traffic-related pollution. These transportation options align with the Proposed Project's commitment to sustainable design and transit-oriented development principles.

### **Neighborhood Revitalization**

The Cambridge Street area of the West End neighborhood is on the verge of a significant economic and physical revitalization, with several proposed developments aimed at improving public infrastructure and commercial spaces. The residential and library components of the Proposed Project will each contribute to these revitalization efforts. The Proposed Project's design and resident services will foster connections among residents, community groups, and local resources in the West End. The new BPL branch library will create a welcoming space where residents, visitors, and local organizations can gather, socialize, and participate in various activities. Additionally, the outdoor plaza between the new mixed-use building and the Otis House and will serve as a valuable new neighborhood amenity that will help strengthen connections to nearby cultural resources and increase the library's visibility to the general public.

#### **1.4.2 Economic Benefits**

The Proponent is committed to providing contract opportunities for Minority and Women-Owned Business Enterprises (M/WBEs) during the pre-construction and construction phases of the Proposed Project. Additionally, the Proponent will work with the selected General Contractor and subcontractors to achieve City of Boston goals for a diverse construction workforce.

##### **Construction Job Creation/Local Hiring and Contracting**

The development of the Proposed Project will generate a substantial number of construction jobs, and the development team is fully committed to achieving the local hiring and diverse contracting goals outlined in the Boston Residents Job Policy (BRJP). Specifically, the development team intends to ensure that at least 51% of the work is performed by Boston residents; at least 51% is performed by minority workers (compared to BRJP standard of 40%), and at least 15% is performed by women (compared to BRJP standard of 12%).

##### **Operations Job Creation**

The Proponent will leverage the expertise of its property management and community impact teams at POAH Communities to provide outstanding management, resident services, and community support. POAH Communities plans to employ three full-time staff members on-site, including a Property Manager, a Maintenance Superintendent, and a Community Impact Coordinator (CIC) to oversee resident services. In addition, the Proposed Project will generate local business vendor opportunities post-construction through janitorial, security, and landscaping contracts.

##### **New Property Tax Revenue**

The Property currently generates no tax revenue because it is owned by the City of Boston and operated for a public use. However, property taxes will be assessed in connection with the residential component of the Proposed Project, which will result in new tax revenue for the City.

##### **Sustainability**

Taking a holistic approach to the building's interaction with its landscape and climate, the Proposed Project will incorporate innovative construction methods aimed at minimizing its

environmental impact during both the construction and operational phases. Consistent with the City of Boston’s climate goals, the proposed building will be constructed using low-carbon construction materials, including hybrid steel and Cross Laminated Timber (CLT), and the building will be designed to Passive House standards. Additionally, the building will be equipped with all-electric heating and cooling systems as well as high-efficiency appliances, fixtures, and lighting.

### **1.5 Inclusionary Development Policy**

The Proposed Project will be 100% affordable and will provide approximately 119 income restricted rental residential units. This level of affordability exceeds the 18% affordability requirement set forth in the Inclusionary Zoning regulations (Section 79-4 of the Code).

### **1.6 Affirmatively Furthering Fair Housing**

The Proposed Project involves the demolition of an existing library building and therefore will not result in the displacement of any residents from the West End neighborhood. Rather, the Proposed Project will significantly contribute to the availability of affordable housing in the West End neighborhood by creating approximately 119 income-restricted units available for households earning less than 80% of AMI. The Proponent has completed the Affirmatively Furthering Fair Housing Assessment (AFFHA), which is included in [Appendix E](#) of this PNF.

### **1.7 Community Engagement**

The Proponent has held several meetings with abutters, neighborhood groups, and elected officials to provide information and gather feedback on the Proposed Project. Throughout this process, the Proponent has maintained a focus on fostering a strong, ongoing partnership with the community, which will extend beyond the Proposed Project's completion. As a result of the Proponent’s community outreach efforts, the Proposed Project has garnered widespread community and political support. A summary of all community engagement activities is provided in [Table 1-3](#) below. Copies of letters of support for the Proposed Project received to date are included in [Appendix L](#) of this PNF. The Proponent will continue to seek feedback from stakeholders throughout the Proposed Project's implementation to ensure that the development remains responsive to community interests and needs.



**Table 1-3 Community Engagement**

<b>Outreach Meetings</b>	<b>Meeting Dates</b>
<b>Pre-RFP Submission Meetings</b>	
Historic New England	<b>Spring 2023</b>
Joe McDonald-West End Resident	<b>Spring 2023</b>
West End Museum Staff	<b>Spring 2023</b>
Blackstone Residents	<b>Fall 2023</b>
<b>Site Abutters</b>	
Mass General Hospital Bi-Annual Community Meeting	<b>1/2024</b>
The Davis Companies (Matt Bergin)	<b>3/2024</b>
Historic New England (Project Review)	<b>4/2024</b>
Mass General Hospital & The Davis Companies	<b>4/2024</b>
Mass General Hospital Bi-Annual Community Meeting	<b>6/2024</b>
Historic New England	<b>7/2024</b>
Massachusetts Eye and Ear	<b>8/2024</b>
Historic New England	<b>11/2024</b>
<b>Neighborhood Groups</b>	
West End Civic Organization	<b>4/2024</b>
Beacon Hill Civic Association	<b>4/2024</b>
<b>Elected Officials</b>	
Boston City Councilor Sharon Durkin	<b>2/2024</b>
Congressman Stephen Lynch District Office Staff	<b>4/2024</b>
State Representative Jay Livingstone	Emailed Project Update (pending meeting)
State Senator Lydia Edwards	Emailed Project Update (pending meeting)
<b>Distribution Of E-Newsletter</b>	Distributed to Neighborhood Groups and Elected Officials

## 1.8 Project Schedule

The estimated construction start is the fourth quarter of 2026.

## **2. General and Legal Information**

This section introduces the development team and presents other general and legal information regarding the Proponent and the Project Site, including a summary of permits and approvals that may be applicable to the Project.

### **2.1 Development Team**

<b>Project Name</b>	<b>West End Library</b>
<b>Proponent</b>	<b>Preservation of Affordable Housing</b> Oliver Street, Suite 500 Boston, MA 02109  <b>Caste Capital</b> 32 Cambridge Street, Boston, MA 02129
<b>Proponent's Project Manager</b>	Kristel Salinas Preservation of Affordable Housing 2 Oliver Street, Suite 500 Boston, MA 02109 <a href="mailto:ksalinas@poah.org">ksalinas@poah.org</a>
<b>Project Architects</b>	<b>MASS Design Group</b> 1 Chandler Street Boston, MA 02116  Jonathan Evans, RA NOMA Principal <a href="mailto:jevans@mass-group.org">jevans@mass-group.org</a>  Megan Altendorf, AIA NCARB Director <a href="mailto:maltendorf@mass-group.org">maltendorf@mass-group.org</a>  <b>The Architectural Team</b> 50 Commandant's Way at Admiral's Hill Chelsea, MA 02150  Michael Liu, AIA NCARB Principal <a href="mailto:MLiu@architecturalteam.com">MLiu@architecturalteam.com</a>  Tom Schultz, AIA NCARB CPHC Principal <a href="mailto:TSchultz@architecturalteam.com">TSchultz@architecturalteam.com</a>

	<p>Andrew Stebbins, LEED AP Associate <a href="mailto:AStebbins@architecturalteam.com">AStebbins@architecturalteam.com</a></p>
<b>Landscape Architect</b>	<p><b>G2 Collaborative</b> 282 Moody Street, Suite 414 Waltham, MA 02453</p> <p>Gigi Saltonstall Principal <a href="mailto:gigi@g2cla.com">gigi@g2cla.com</a></p> <p>Lisa Giersbach Principal <a href="mailto:lisa@g2cla.com">lisa@g2cla.com</a></p> <p>Patricia Noto Associate Designer <a href="mailto:patricia@g2cla.com">patricia@g2cla.com</a></p>
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## **2.2 Legal Information**

### **2.2.1 Legal Judgments Adverse to the Proposed Project**

The Proponent has no knowledge of any legal judgements in effect or actions pending that are adverse to the Proposed Project.

### **2.2.2 History of Tax Arrears on the Property**

The Proponent has no knowledge of any tax arrearage on the property.

### **2.2.3 Evidence of Site Control/Nature of Public Easements**

On December 13, 2023, the Proponent was selected by the PFC to redevelop the Project Site. The Proponent will enter into a ground lease with the City of Boston, the current owner of the Project Site, which will enable the Proponent to construct the Proposed Project and operate the residential component. The Proponent is not aware of any public easements traversing or affecting any portion of the Project Site, with the exception of the Taking for widening, relocation and construction of Cambridge Street by the Public Improvement Commission of the City of Boston dated May 31, 1966, and recorded with the Suffolk County Registry of Deeds in Book 8070, Page 439.

## **2.3 Zoning Information**

### **2.3.1 Article 80B Large Project Review**

Since the Proposed Project exceeds 50,000 square feet of Gross Floor Area (GFA) and is located in the Downtown, it is subject to Large Project Review by the Boston Planning Department (the “Planning Department”) pursuant to Article 80B of the Code. The Large Project Review process was commenced by the filing of a Letter of Intent (LOI) with the Planning Department on August 8, 2024, a copy of which is included in [Appendix K](#) of this PNF.

### **2.3.2 Zoning District**

The Project Site is located within the Cambridge Street North Side Protection Area of the Cambridge Street North Zoning District, which is governed by Article 47A of the Code. The Project Site is also located within the Restricted Parking Overlay District (“RPOD”), governed by Section 3-1A(c) of the Code, and the area subject to the Downtown Boston Parking Freeze (the “Parking Freeze”).

### **2.3.3 Uses**

The Proposed Project is anticipated to include a new two-story library branch, approximately 119 income-restricted residential units above the new library branch, and open space and amenities for library visitors, building residents, and the public.

Under current zoning, library use is allowed as of right both on and above the ground floor. Lobby space for residences is allowed as of right on the ground floor, and residential use (including uses accessory to residential use such swimming pool, health club, and tennis court) are allowed as of right above the ground floor. Article 47A of the Code does not contain an “open space” use category. However, public/private park is an allowed use on the ground floor.

### **2.3.4 Dimensional Regulations**

Article 47A of the Code imposes the following dimensional requirements:

- › A maximum Floor Area Ratio (“FAR”) of 5.0;
- › A maximum building height of 65 feet;
- › A maximum Street Wall (as defined in the Code) height of 65 feet; and
- › A minimum Street Wall setback of 65 feet beginning at a building height of 65 feet.

The Proposed Project will exceed the maximum FAR requirement, maximum building height requirement, maximum Street Wall height requirement, and minimum Street Wall setback requirement. Therefore, the Proposed Project will require zoning relief.

### **2.3.5 Off-Street Parking and Loading**

Pursuant to Section 47A-13 of the Code, no off-street parking is required within the Cambridge Street North Zoning District.

As noted above, the Project Site is located in the RPOD as well as the Parking Freeze area. However, because the Proposed Project does not propose any parking, neither the Parking Freeze regulations nor the RPOD provisions set forth in Section 3-1A(c) of the Code are applicable to the Proposed Project.

### **2.3.6 Zoning Relief**

The Proposed Project intends to obtain zoning relief through a 121A designation.



## 2.4 Anticipated Regulatory Controls and Permits

*Table 1-4 List of Anticipated Project Permits and Approvals*

Agency/Department	Permit/Approval/Action
<b>City of Boston</b>	
Boston Planning & Development Agency/ Boston Planning Department	<ul style="list-style-type: none"> <li>› Article 80B Large Project Review</li> <li>› Design Review</li> <li>› Section 80B-6 Certification of Compliance</li> <li>› Cooperation Agreement</li> </ul>
Boston Planning Department (via approval pursuant to M.G.L. Chapter 121A)	<ul style="list-style-type: none"> <li>› 121A Agreement</li> <li>› Zoning relief</li> </ul>
Boston Civic Design Commission	<ul style="list-style-type: none"> <li>› Schematic Design Review</li> </ul>
Boston Inspectional Services Department	<ul style="list-style-type: none"> <li>› Demolition Permits</li> <li>› Building Permit</li> <li>› Other construction-related permits</li> <li>› Certificates of Occupancy</li> </ul>
Boston Landmarks Commission	<ul style="list-style-type: none"> <li>› Article 85 Demolition Delay Review</li> </ul>
Boston Public Improvement Commission/Public Works Department	<ul style="list-style-type: none"> <li>› Specific Repair Plan (as applicable)</li> <li>› Curb Cut Permit (as applicable)</li> <li>› Street Opening Permit (as applicable)</li> <li>› Sidewalk Occupancy Permit (as applicable)</li> <li>› Place of Assembly Permit(s) (as applicable)</li> </ul>
Boston Transportation Department	<ul style="list-style-type: none"> <li>› Construction Management Plan (CMP)</li> <li>› Transportation Access Plan Agreement (TAPA)</li> </ul>
Boston Water and Sewer Commission	<ul style="list-style-type: none"> <li>› Site Plan Review/General Service Application</li> <li>› Dewatering Discharge Permit (as applicable)</li> <li>› Temporary Construction Dewatering Permit (issued jointly with MWRA) (as applicable)</li> <li>› Water and Sewer Connection Permits</li> </ul>
<b>Commonwealth of Massachusetts</b>	

Agency/Department	Permit/Approval/Action
Executive Office of Energy and Environmental Affairs (MEPA Office)	<ul style="list-style-type: none"> <li>› Review under Massachusetts Environmental Policy Act (as applicable)</li> <li>› MEPA Certificate (if Project requires MEPA review)</li> </ul>
Massachusetts Historical Commission	› State Register Review (as applicable)
Massachusetts Water Resources Authority	› Temporary Construction Dewatering Permit (issued jointly with BWSC) (as applicable)
<b>Federal</b>	
U.S. Environmental Protection Agency	› NPDES Dewatering and Remediation General Permit
Federal Aviation Administration	› Determination of No Hazard to Air Navigation (as applicable)

### **3. Urban Design**

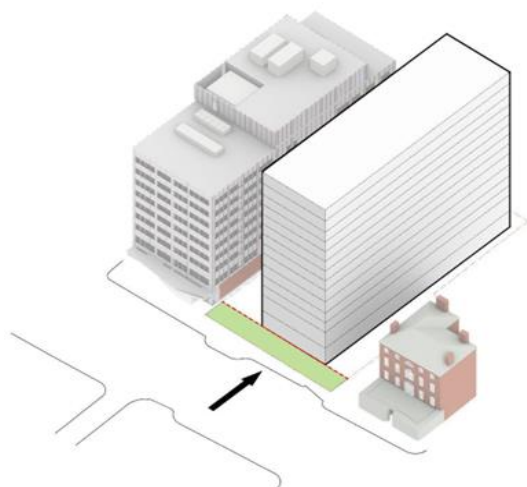
#### **3.1 Existing Site and Area Context**

The Project Site features prominently along Cambridge Street in the West End. To its west and north are the large towers and institutional buildings that are hallmarks of the post-urban renewal neighborhood. To the east and south across Cambridge Street in Beacon Hill are buildings that are tied to Boston's iconography. The Project Site is in the Cambridge Street North-Side Protection Area and within the area of the West End Urban Renewal Plan. This speaks to the area's historic character, growing an institutional built landscape and a thriving public realm.

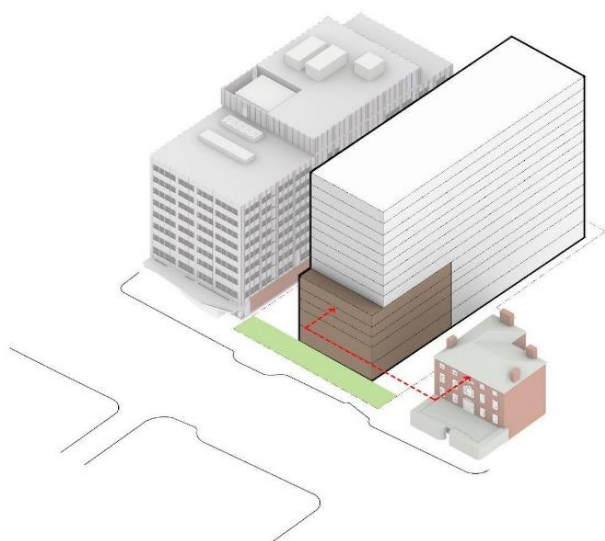
The physical and social landscape of the West End was dramatically changed during the urban renewal era. The West End neighborhood had been a melting pot of cultures grounded by vibrant social and civic institutions. As part of the project team's contextual research, they interviewed Joe McDonald, a third generation West End resident, who described a sense of community, belonging, and connection that he believes has given way to a neighborhood that is resource-rich but lacking those community ties of prior generations. This understanding of the West End neighborhood informed how the Proposed Project's design prioritizes the location and expression of interior and exterior community spaces so that they can be impactful for residents and the general public.

#### **3.2 Urban Design Logic**

The Proposed Project's massing and design is driven by the character of the existing neighborhood fabric. The buildings that immediately abut the Project Site reflect different eras of the West End's history. This allows the Proposed Project's massing to meaningfully dialogue with this layering of scales, datums and materiality to create something that is rooted in the flows of its context. To illustrate this, the following sequence demonstrates how the Proposed Project was developed to integrate with the West End neighborhood.

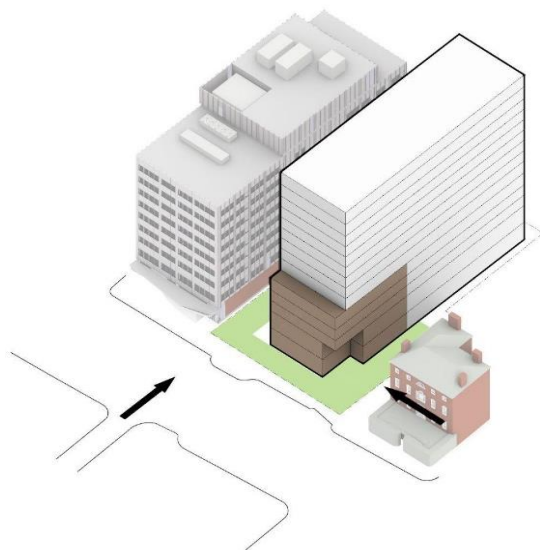


1. A prototypical tower block reflects the scale of the program. As an initial step, the massing is setback approximately 22 feet from the front property line along Cambridge Street. This establishes a large public realm zone that is separate from the existing sidewalk.



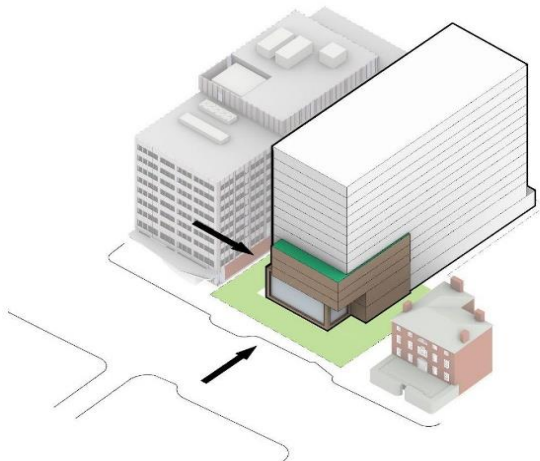
2. The 14-story massing is set back above the fifth story to create a front lower volume that is comparable in scale to the neighboring Otis House and Old West Church. This frontispiece is a design opportunity to show how the combination of library and affordable housing programming can enhance civic life in the West End.

This set back of the upper volume also reduces the impact of the tower volume on the experience of the Cambridge Street public realm.



3. A publicly accessible open space is created between the project and the Otis House. This open space is given scale and prominence by carving a void out of the front massing. This open space has the potential to create a cohesive civic realm off Cambridge Street connecting the Proposed Project to the Otis House.

Along Cambridge Street, the project holds and enhances the historic streetwall and creates meaningful exterior public space for the library along its frontage. Then at the western edge, a private open space for library use is created. This location aligns with Joy Street coming down from Beacon Hill and also references the previous location of Chambers Street that was removed during urban renewal.

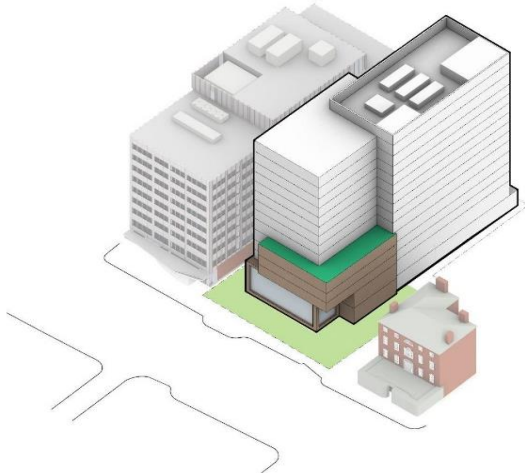


4. Building from the planning work done by the BPL team, the design seeks to create a space for the West End Library Branch that is welcoming and embraces the neighborhood. To that end, the two-story library volume slightly slides free of the overall five-story lower brick volume. Additionally, this area features generous window walls along its frontage to connect the library space to the neighborhood.

Together, this massing slide and material consideration give prominence and hierarchy to the library within the Project Site and sets it up as a civic anchor for the neighborhood.



5. The bulk of the upper tower volume is then broken down with a horizontal shear to split it into two distinct masses. The move pushes massing to the west which gives more space to respect the presence of the Otis House and reduces shadow impacts. From a building perspective, this unlocks an opportunity for common spaces at the residential interior to benefit from attractive views overlooking Beacon Hill.



6. The perimeter walls of the rear tower mass are then extended up to create a continuous screening element to hide rooftop equipment and other back-of-house functions. This would be treated architecturally in a manner consistent with the rest of the facade and yields a one-story difference between the two tower masses which further helps break down the bulk of the tower.

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The building massing moves embrace the physical characteristics of the urban fabric and put forth a design that honors its place. Beyond the physical dimension, the spaces created from these moves become the social heart of the Proposed Project as they seek to make space for meaningful community life both within the building and the outdoor public realm.

### **3.3 Landscape Design**

The design of the public realm aims to provide additional community assets by creating inviting and accessible exterior spaces. The landscape at the front of the library features an elevated “porch” which adds clarity and presence to the library entrance. Steps negotiate the falling grade across the Cambridge Street sidewalk from east to west and the elevation of the porch meets grade to the east creating an accessible walkway. Planters and fixed seating provide green places of respite at either side of the front doors. Four street trees frame the library entrance and provide both shade and distinction between the street and library entry walk. This walkway also connects to the adjacent residential entry, the historic Otis House, and the landscape between them.

The landscape surrounding the residential entrance creates a welcoming neighborhood open space for visitors and the community. Plant beds with integrated seating bring pedestrian scale to the space and also aim to create as much permeability as possible to this area. Smaller columnar trees are planted throughout the shared open space both within the plant beds and in the paving. The design for this shared space balances program desires, such as gathering for community events, planting, and intermittent vehicular access.

A 12’ wide vehicular lane will be paved and kept clear of permanent structures to service occasional building needs such as transformer servicing and tenant moving trucks. Lighted bollards are included to ensure pedestrian safety and will also be a part of a larger lighting strategy.

Seating in this area will build on the idea of the historic culture of the West End and its lively stoops. Tiered seating allows community members and visitors to perch and find respite from the busy street. Playful elements such as color and multifunctional seating invite and accommodate visitors of many ages.

### **3.4 Building Design**

Building from the massing, the facade design is also rooted in an appreciation of the West End neighborhood. Brick is prominently used here throughout as a timeless material with the richness, warmth and texture that is linked to the context, but here it is deployed in a manner that is confidently contemporary and of its time.

Starting from the top, the tower features brick frames with vertical piers that bring significant depth with unique corbelling and bonding patterns. This brick framework organizes the facade and moving down to the lower front mass, the vertical elements are heftier to bring more depth and detailing down at this human scale. Additionally, secondary panel elements across the building provide warmth and texture as they evoke historic wood shutters that adorn historic windows around Beacon Hill.

The design celebrates the community programming throughout the building. Community spaces and outdoor zones are treated as subtle exceptions for the organizing architectural language of the rest of the building.

The library space grounds the overall project as it builds directly from planning work done by the BPL. The design fosters an active public realm along Cambridge Street and creates a building that feels welcoming and inviting. The two-story library volume features generously sized window walls that celebrate the activity within the space - putting it on display to animate the public realm and anchor civic life for the West End neighborhood.

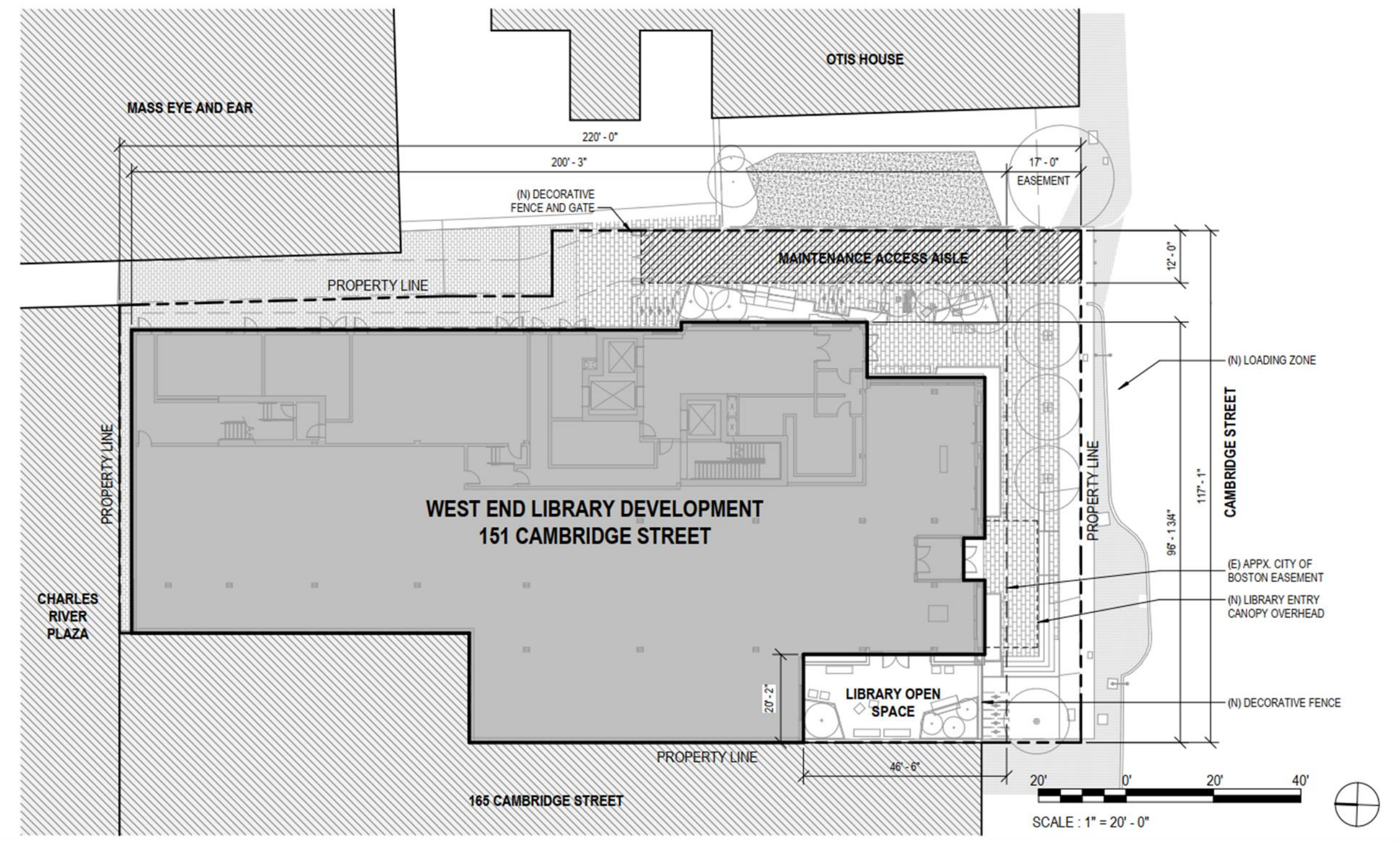


Figure 3-01 Aerial Locus Map





Figure 3-02 Architectural Site Plan



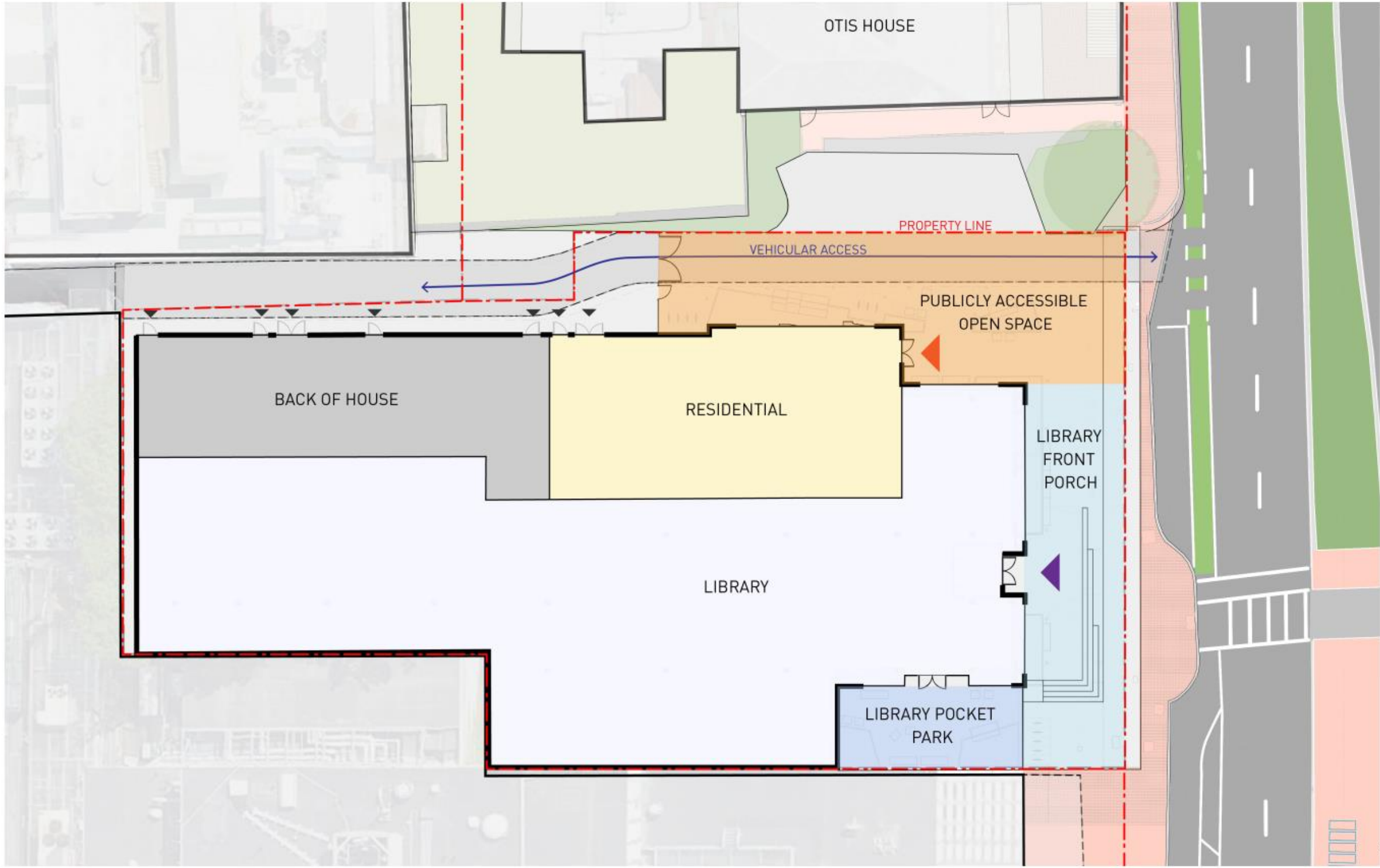
WEST END LIBRARY DEVELOPMENT  
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ARCHITECTURAL SITE PLAN  
FIGURE 3-02

MASS. tat



Figure 3-03 Site Diagram (Ground Level)



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SITE DIAGRAM (GROUND LEVEL)  
FIGURE 3-03

MASS. tat

Figure 3-04 Public Realm Plan



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**PUBLIC REALM PLAN**  
**FIGURE 3-04**

**MASS. tat**



Figure 3-05 Public Realm Plan



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**PUBLIC REALM PLAN**  
**FIGURE 3-05**

**MASS. tat**



Figure 3-06 Public Realm (Axon View)



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**PUBLIC REALM (AXON VIEW)**  
**FIGURE 3-06**

**MASS. tat**



Figure 3-07 Aerial Perspective from Southwest



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**AERIAL PERSPECTIVE FROM SOUTHWEST**  
**FIGURE 3-07**

**MASS. tat**



Figure 3-08 Perspective Looking from South along Cambridge Street



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**PERSPECTIVE LOOKING FROM SOUTH ALONG CAMBRIDGE STREET**  
**FIGURE 3-08**

**MASS. tat**



Figure 3-09 Perspective Looking from South along Cambridge Street



**WEST END LIBRARY DEVELOPMENT**  
151 CAMBRIDGE ST | DEC 2024 | POAH & CASTE CAPITAL |

**PERSPECTIVE LOOKING FROM SOUTH ALONG CAMBRIDGE STREET**  
**FIGURE 3-09**

**MASS. tat**



Figure 3-10 Perspective Looking from Southeast Along Cambridge Street



**WEST END LIBRARY DEVELOPMENT**  
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**PERSPECTIVE LOOKING FROM SOUTHEAST ALONG CAMBRIDGE STREET**  
**FIGURE 3-10**

**MASS. tat**



Figure 3-11 Perspective Looking from Southwest Along Cambridge Street



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PERSPECTIVE LOOKING FROM SOUTHWEST ALONG CAMBRIDGE STREET  
FIGURE 3-11

MASS. tat



Figure 3-12 Perspective Looking from Southeast Along Cambridge Street



**WEST END LIBRARY DEVELOPMENT**  
151 CAMBRIDGE ST | DEC 2024 | POAH & CASTE CAPITAL |

**PERSPECTIVE LOOKING FROM SOUTHEAST ALONG CAMBRIDGE STREET**  
**FIGURE 3-12**

**MASS. tat**



Figure 3-13 Perspective Looking from East Along Otis House



**WEST END LIBRARY DEVELOPMENT**  
151 CAMBRIDGE ST | DEC 2024 | POAH & CASTE CAPITAL |

**PERSPECTIVE LOOKING FROM EAST ALONG OTIS HOUSE**  
**FIGURE 3-13**

**MASS. tat**



Figure 3-14 Overall Floor Plan – Basement 01

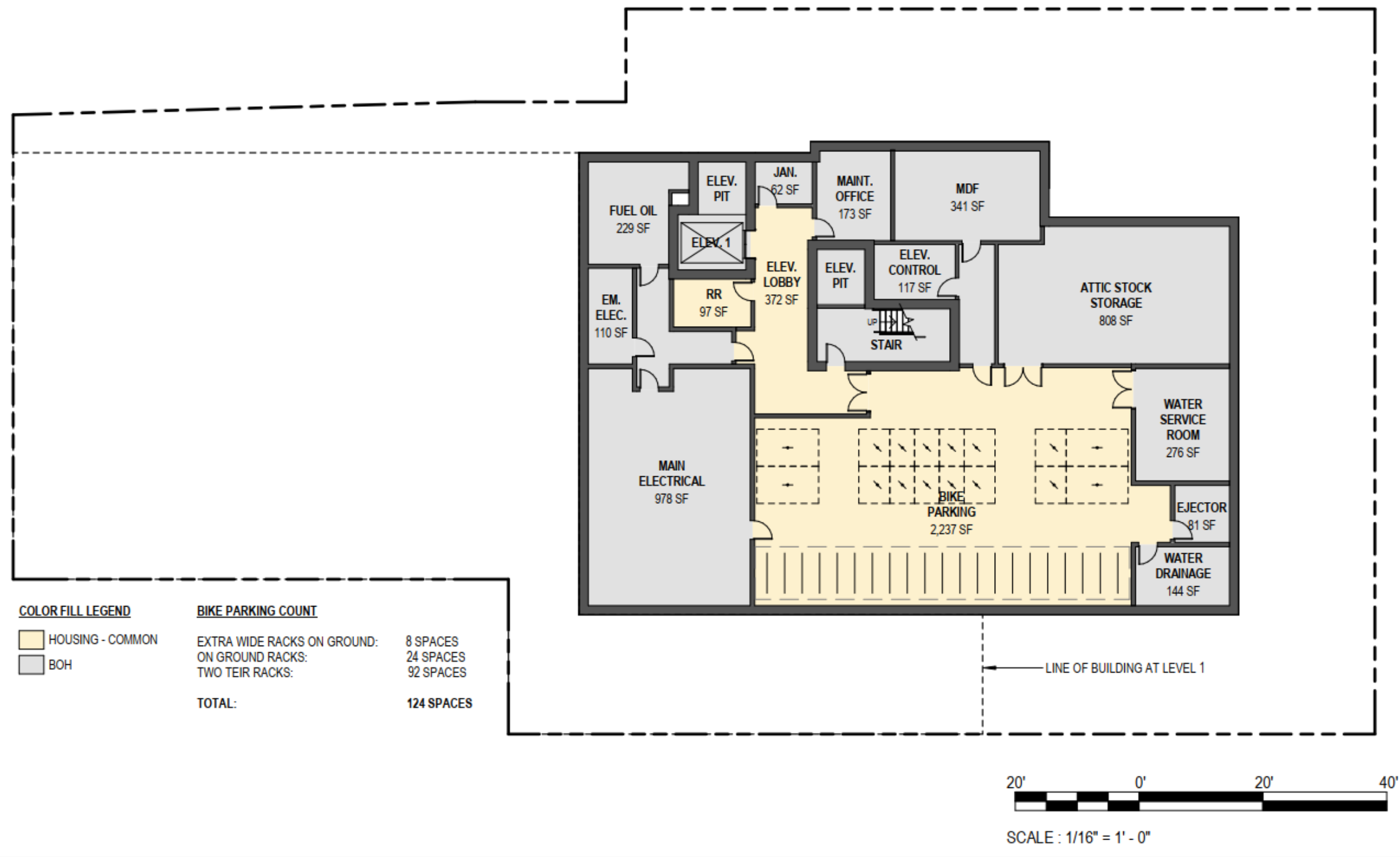


Figure 3-15 Overall Floor Plan – Level 01

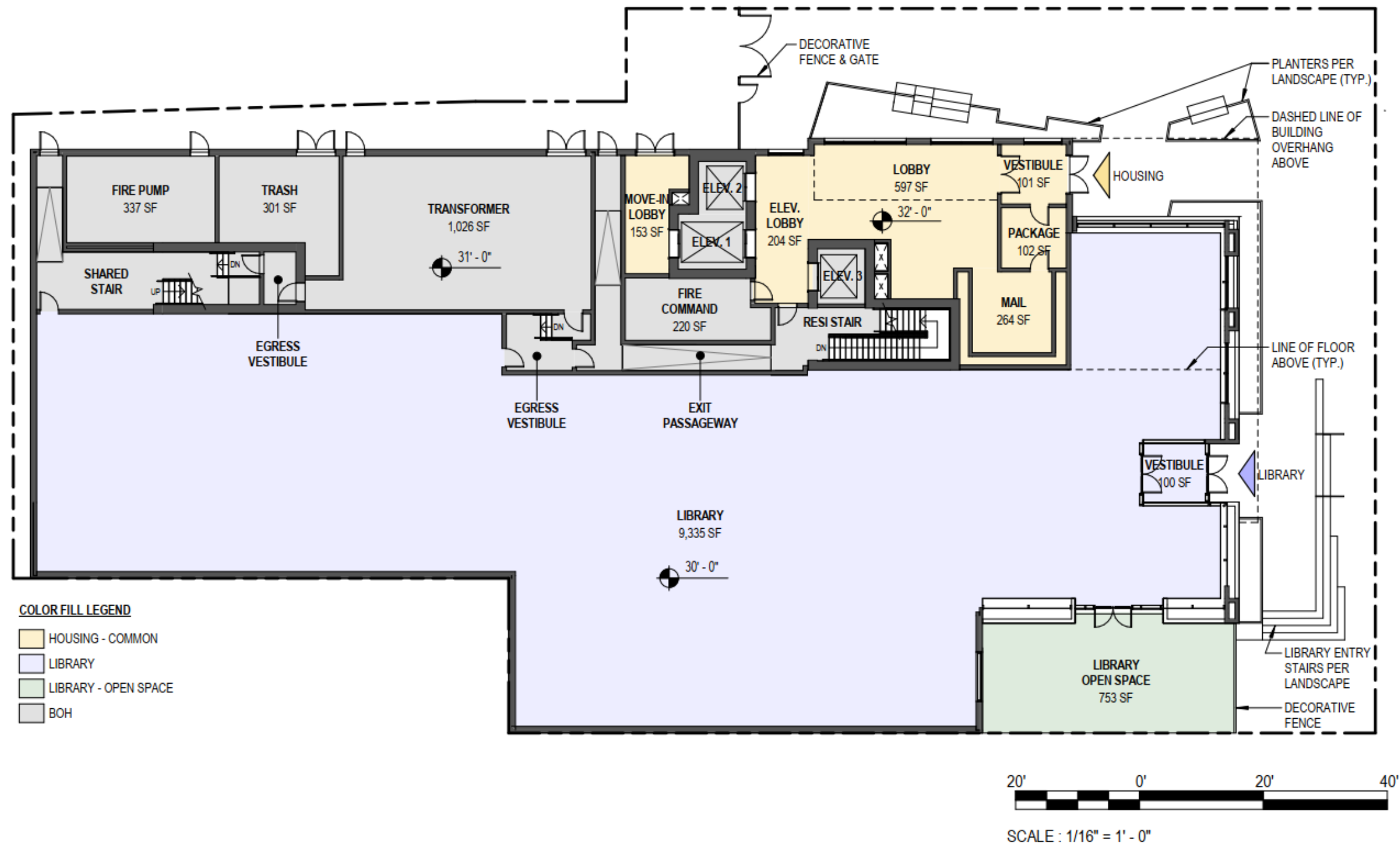


Figure 3-16 Overall Floor Plan – Level 02

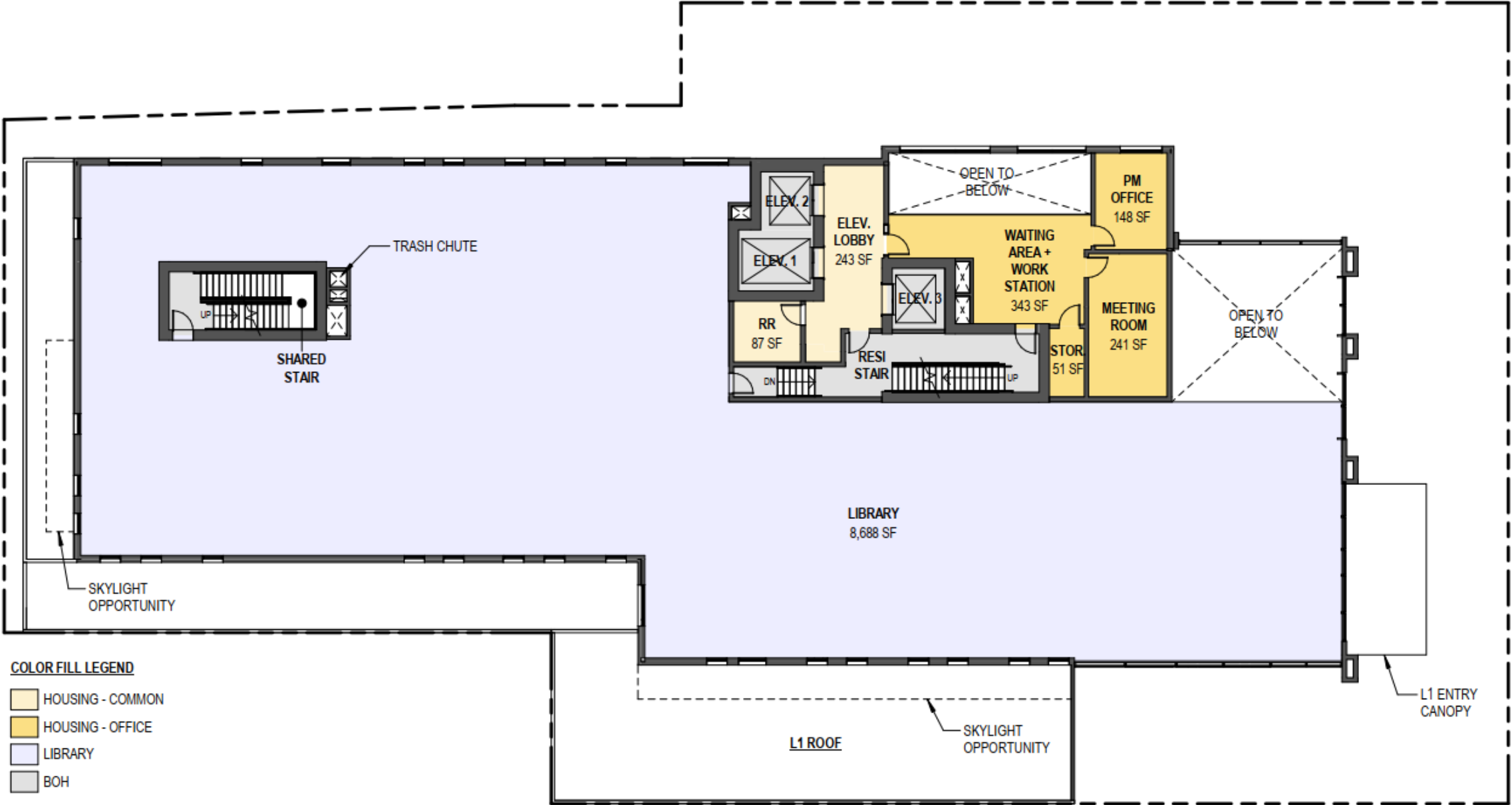




Figure 3-17 Overall Floor Plan – Level 03



Figure 3-18 Overall Floor Plan – Level 04



Figure 3-19 Overall Floor Plan – Level 05



Figure 3-20 Overall Floor Plan – Level 06



Figure 3-21 Overall Floor Plan – Level 07



Figure 3-22 Overall Floor Plan – Level 08





Figure 3-23 Overall Floor Plan – Level 09

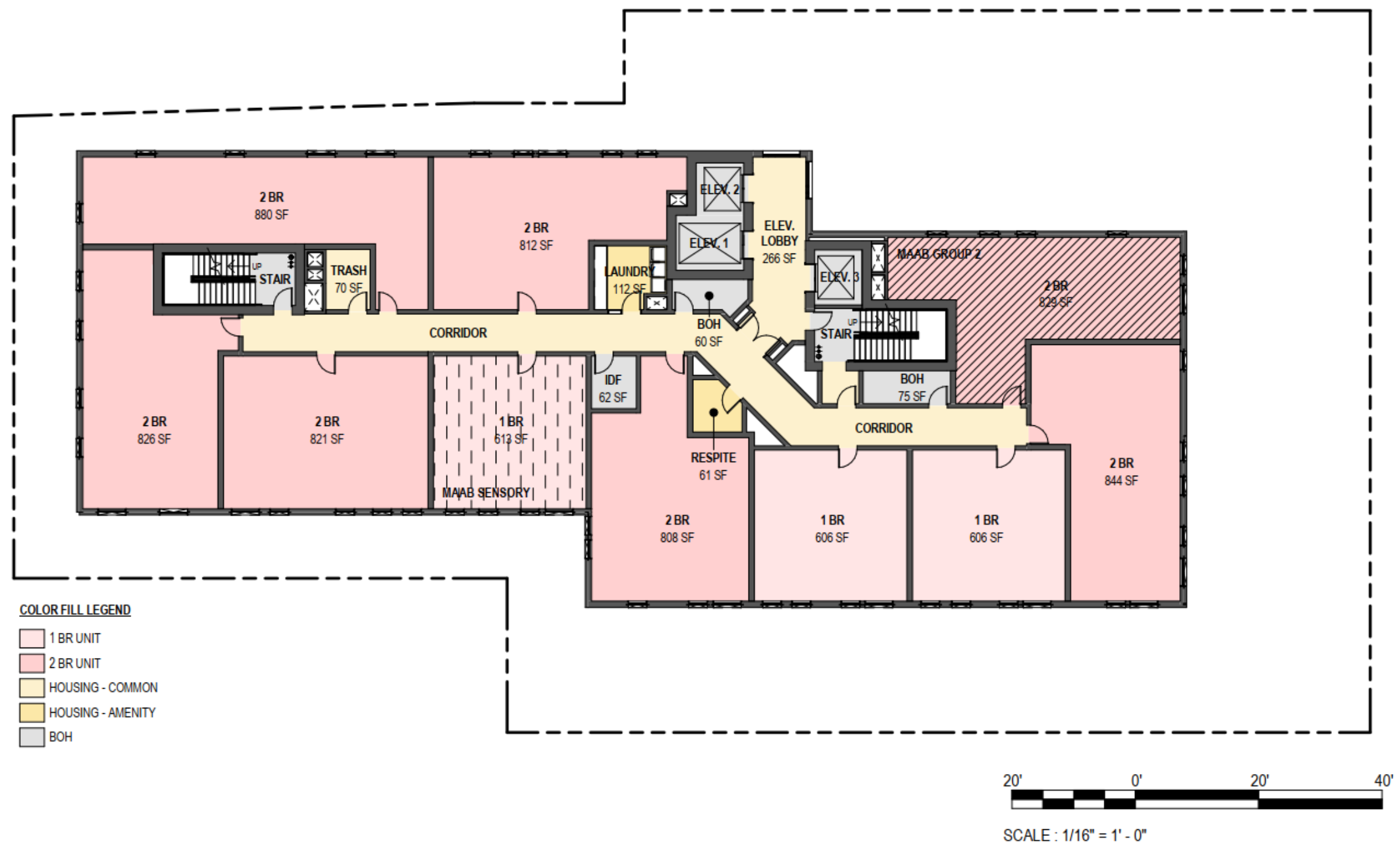


Figure 3-24 Overall Floor Plan – Level 10

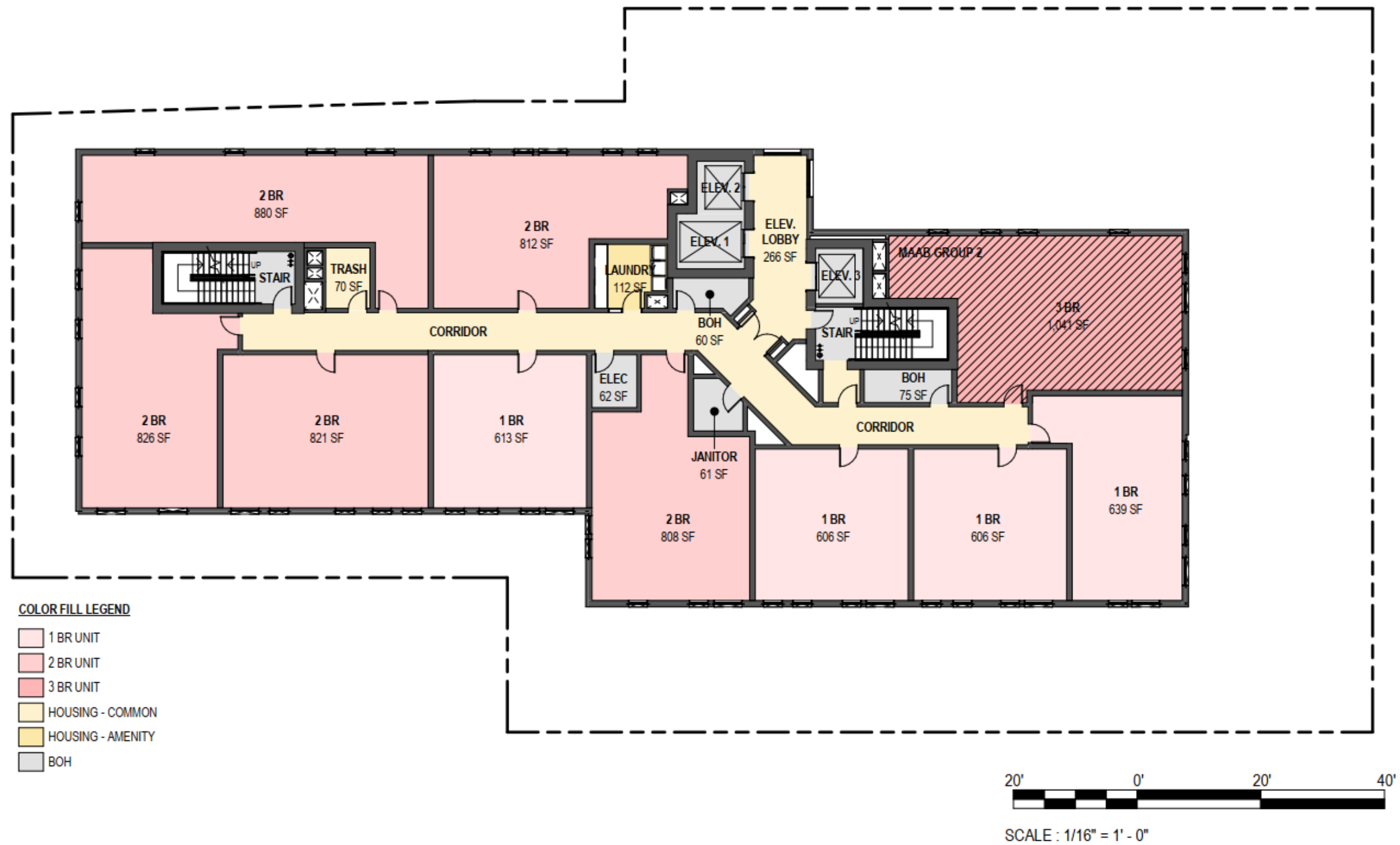




Figure 3-25 Overall Floor Plan – Level 11

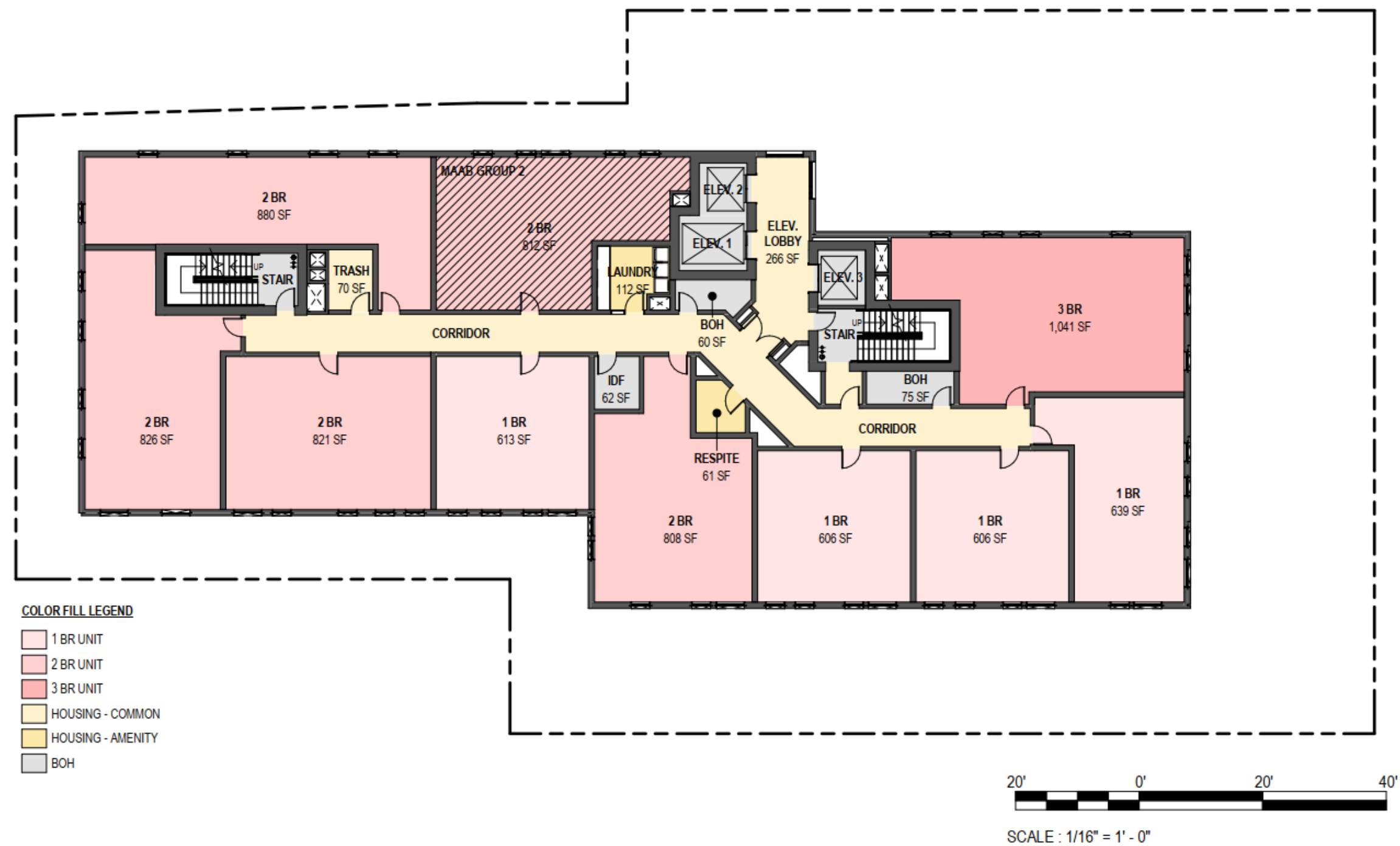


Figure 3-26 Overall Floor Plan – Level 12



Figure 3-27 Overall Floor Plan – Level 13



Figure 3-28 Overall Floor Plan – Level 14



Figure 3-29 Overall Floor Plan – Overall Floor Plan – Roof

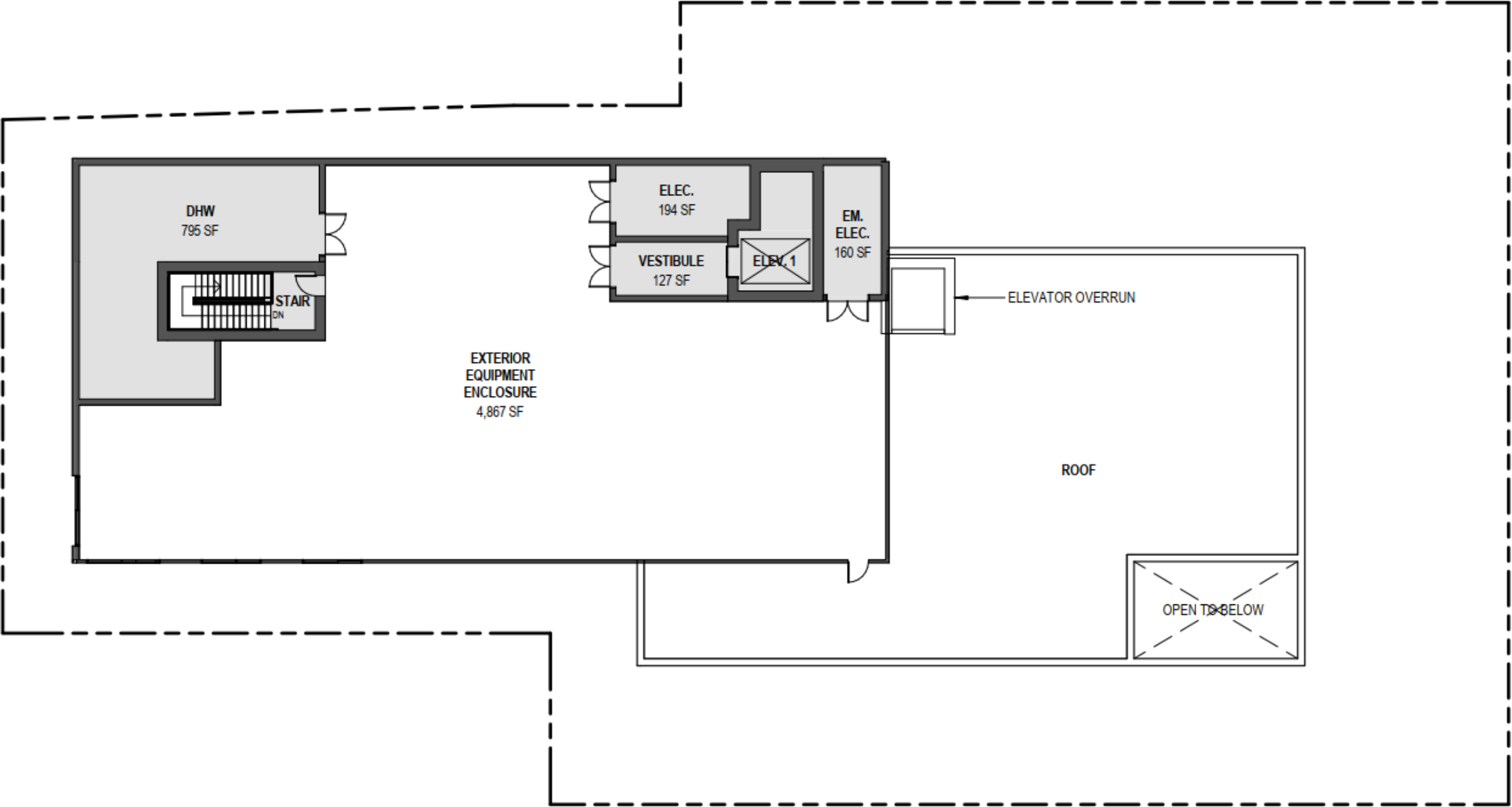




Figure 3-30 Building Elevations – South

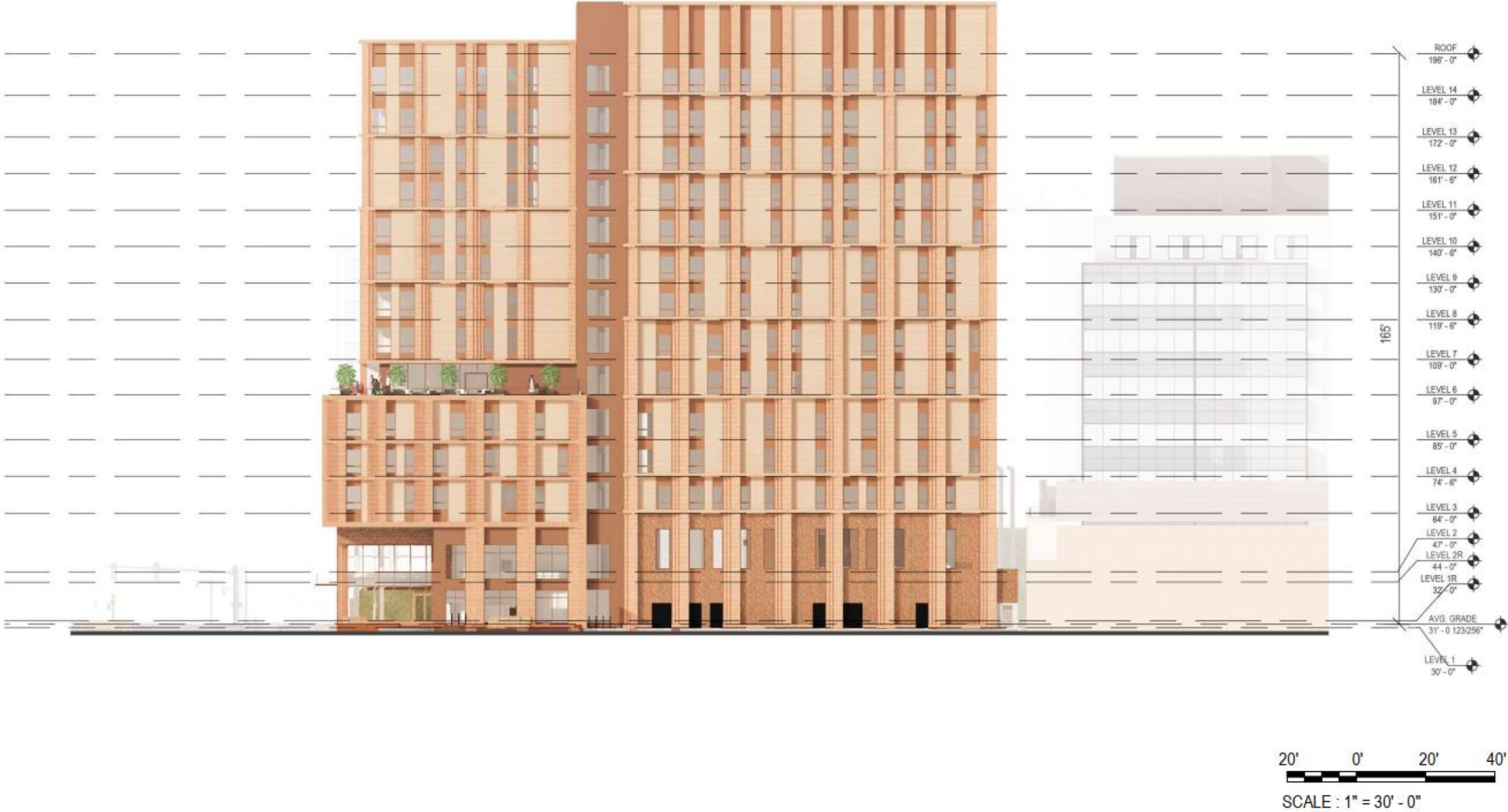


**WEST END LIBRARY DEVELOPMENT**  
151 CAMBRIDGE ST | DEC 2024 | POAH & CASTE CAPITAL |

**BUILDING ELEVATIONS - SOUTH**  
**FIGURE 3-30**

**MASS. tat**

Figure 3-31 Building Elevations – East



**WEST END LIBRARY DEVELOPMENT**  
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**BUILDING ELEVATIONS - EAST**  
**FIGURE 3-31**

**MASS. tat**



Figure 3-32 Building Elevations – North



WEST END LIBRARY DEVELOPMENT  
151 CAMBRIDGE ST | DEC 2024 | POAH & CASTE CAPITAL |

BUILDING ELEVATIONS - NORTH  
FIGURE 3-32

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Figure 3-33 Building Elevations – West

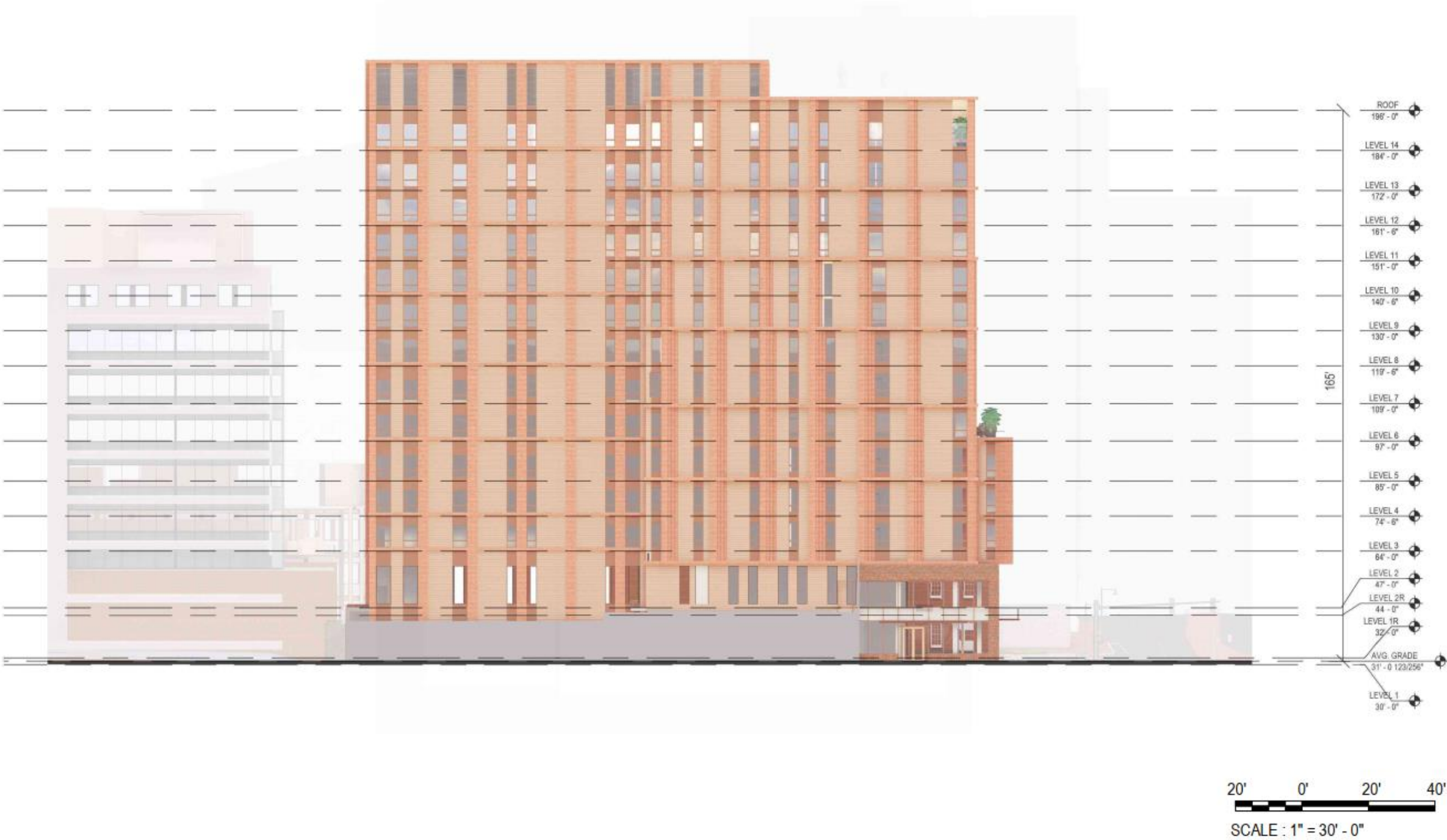


Figure 3-34 Building Sections – North – South

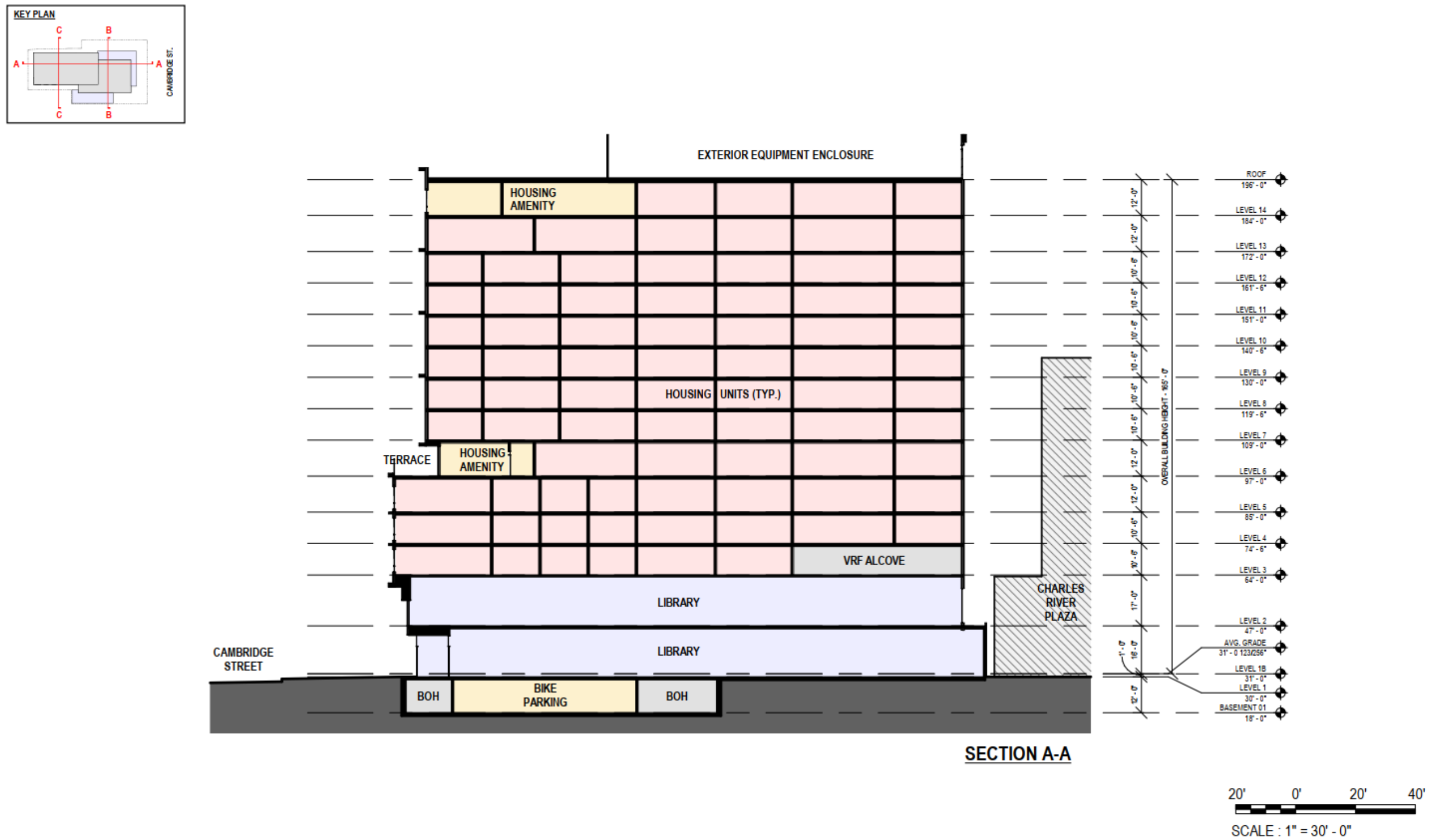


Figure 3-35 Building Sections – East – West

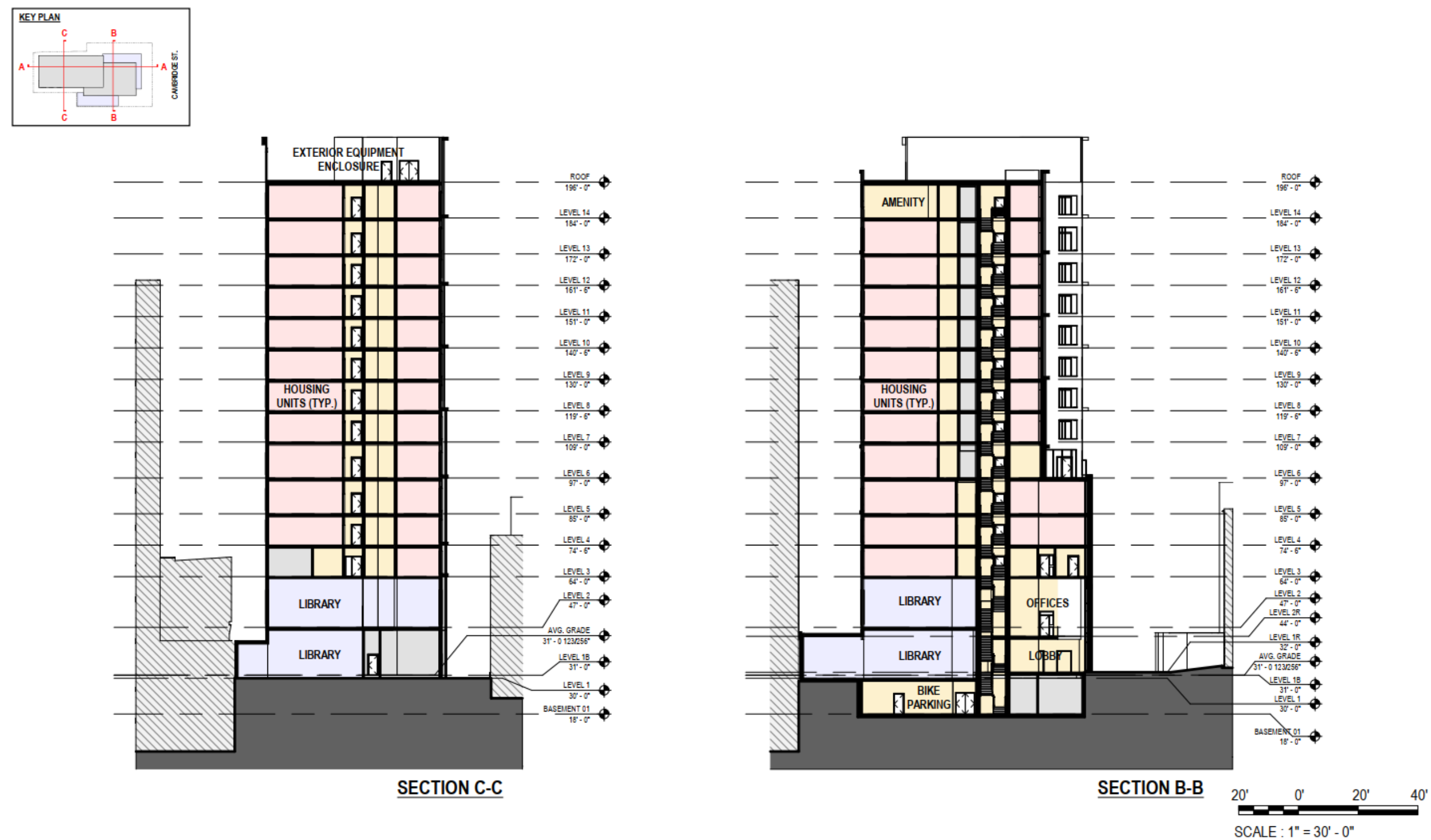


Figure 3-36 Shadow Studies



WEST END LIBRARY DEVELOPMENT  
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SHADOW STUDIES  
FIGURE 3-36

MASS. tat



Figure 3-37 Shadow Studies



Figure 3-38 Shadow Studies



WEST END LIBRARY DEVELOPMENT  
151 CAMBRIDGE ST | DEC 2024 | POAH & CASTE CAPITAL |

SHADOW STUDIES  
FIGURE 3-38

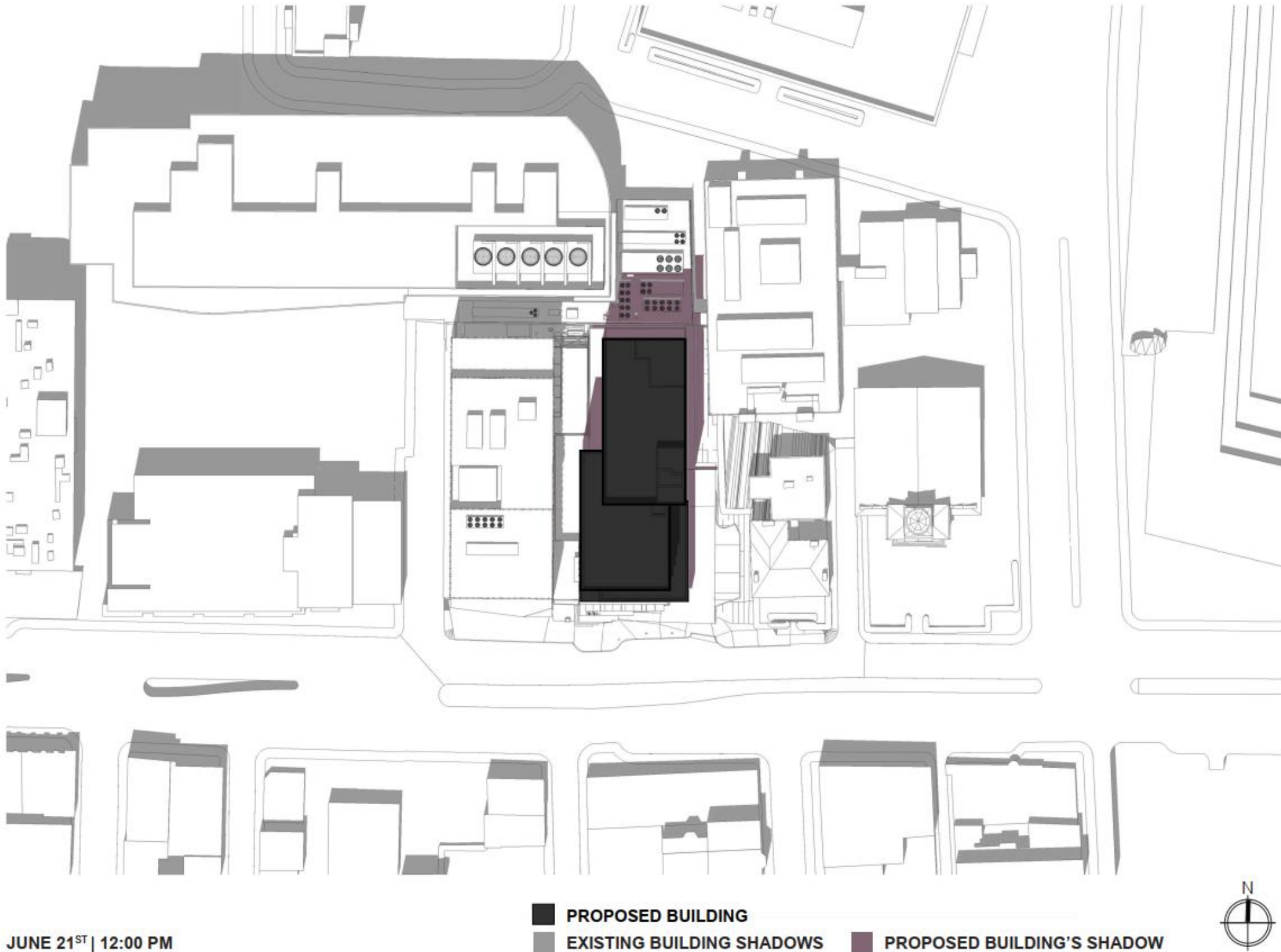
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Figure 3-39 Shadow Studies





Figure 3-40 Shadow Studies



WEST END LIBRARY DEVELOPMENT  
151 CAMBRIDGE ST | DEC 2024 | POAH & CASTE CAPITAL |

SHADOW STUDIES  
FIGURE 3-40

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Figure 3-41 Shadow Studies

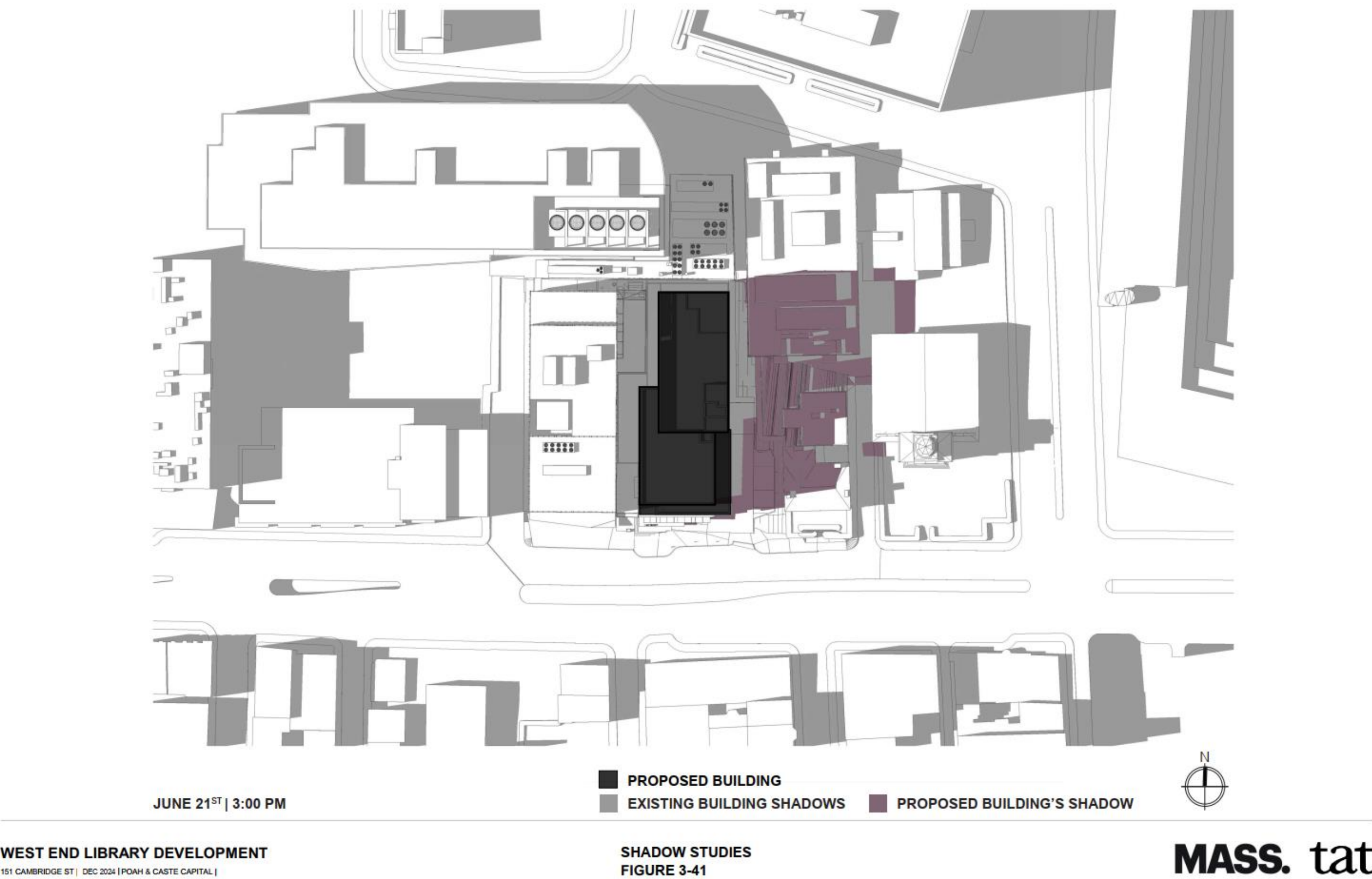


Figure 3-42 Shadow Studies



Figure 3-43 Shadow Studies





Figure 3-44 Shadow Studies



WEST END LIBRARY DEVELOPMENT  
151 CAMBRIDGE ST | DEC 2024 | POAH & CASTE CAPITAL |

SHADOW STUDIES  
FIGURE 3-44

MASS. tat



Figure 3-45 Shadow Studies



WEST END LIBRARY DEVELOPMENT  
151 CAMBRIDGE ST | DEC 2024 | POAH & CASTE CAPITAL |

SHADOW STUDIES  
FIGURE 3-45

MASS. tat

Figure 3-46 Shadow Studies



WEST END LIBRARY DEVELOPMENT  
151 CAMBRIDGE ST | DEC 2024 | POAH & CASTE CAPITAL |

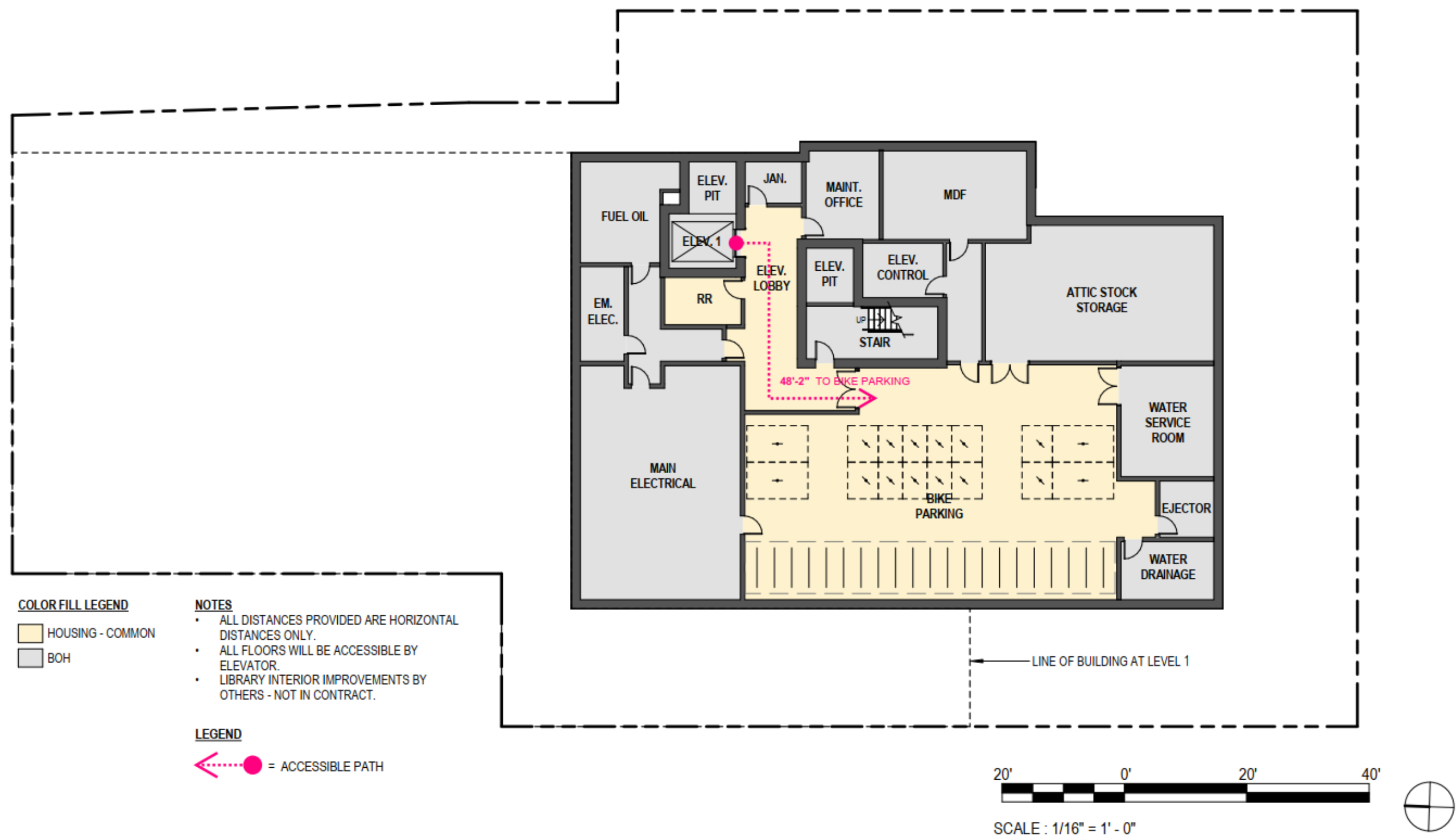
SHADOW STUDIES  
FIGURE 3-46

MASS. tat

Figure 3-47 Shadow Studies



Figure 3-48 Accessibility Plan – Basement 01





**Figure 3-49 Accessibility Plan – Level 01**

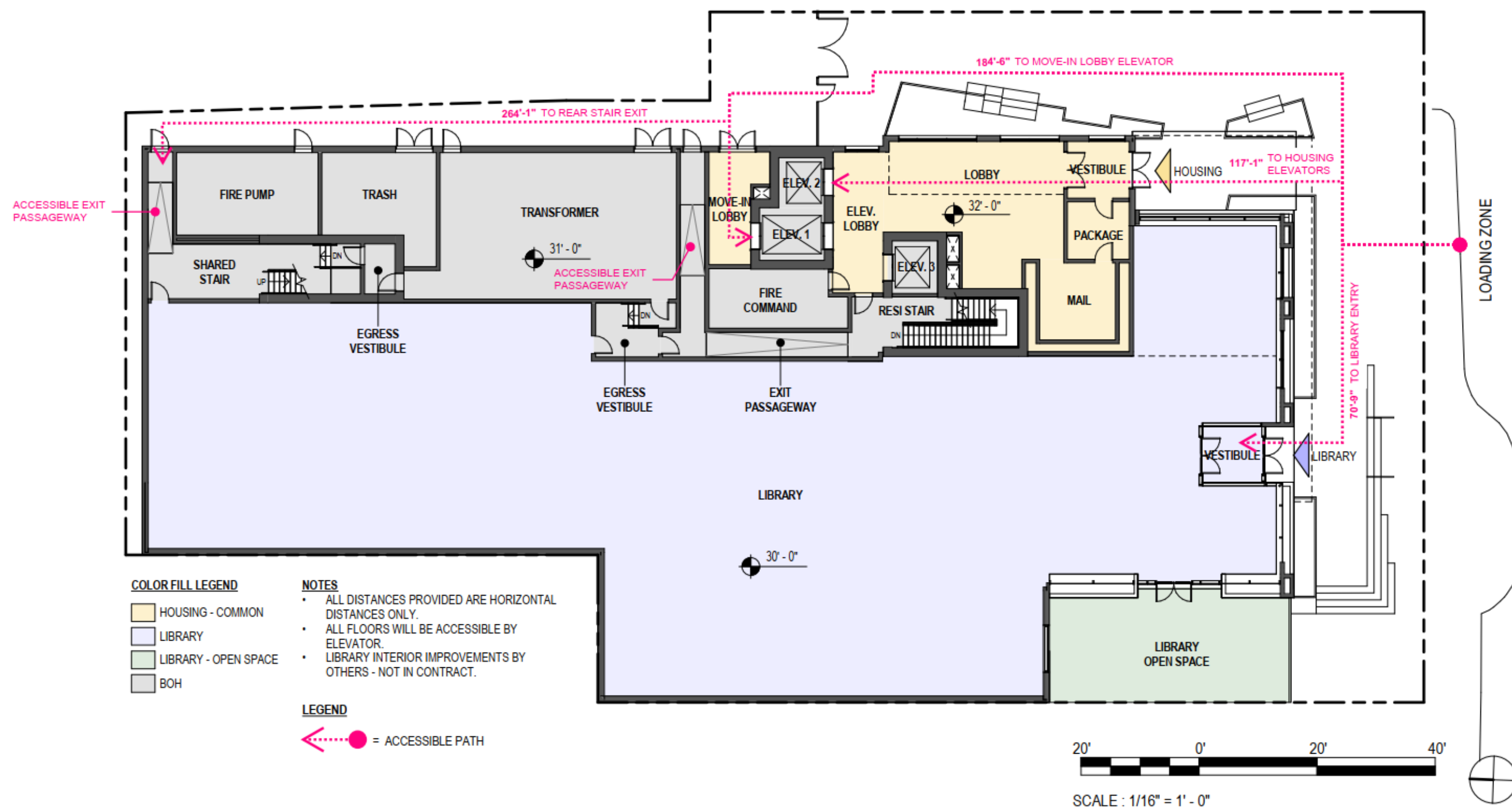


Figure 3-50 Accessibility Plan – Level 02

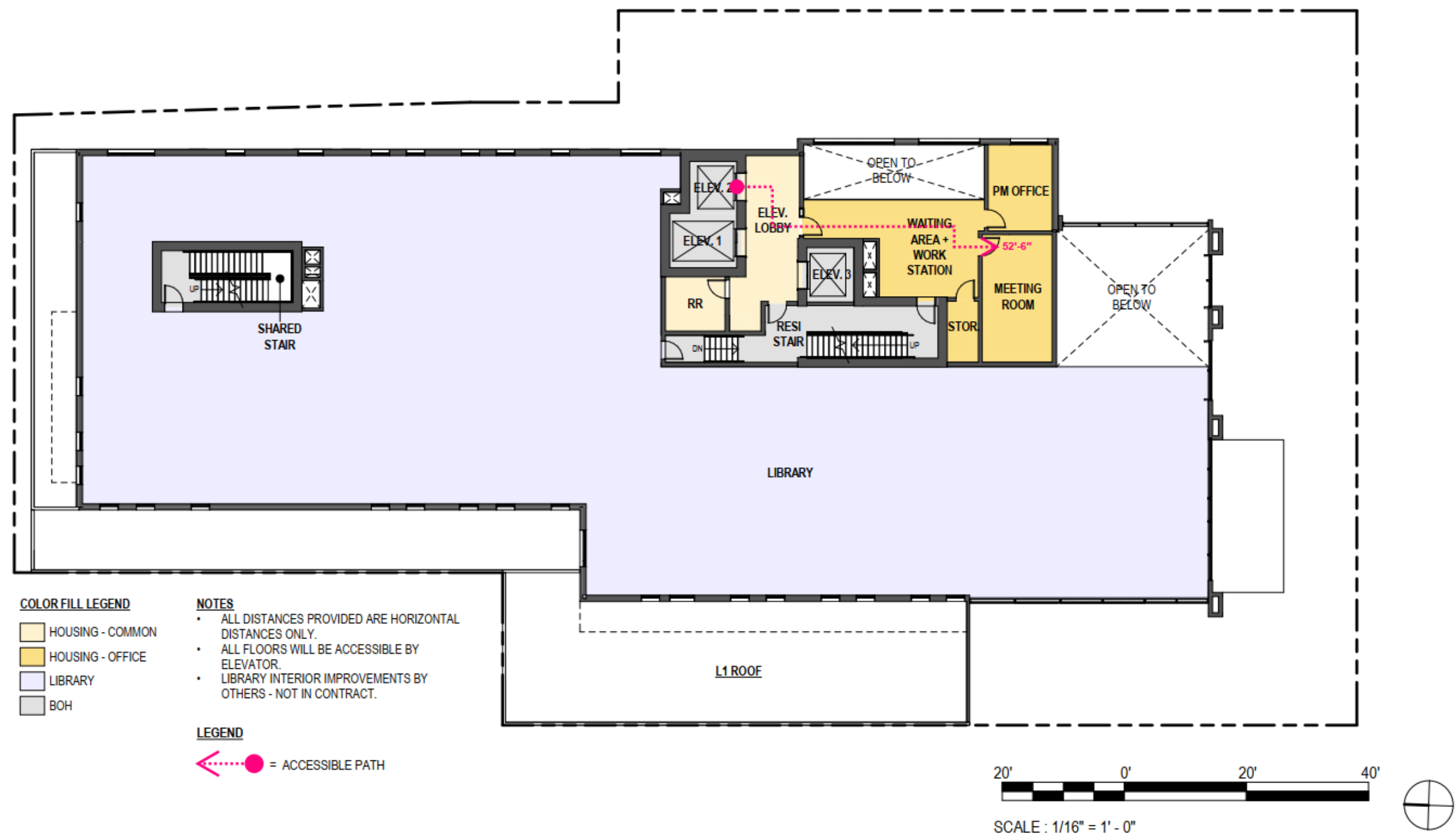


Figure 3-51 Accessibility Plan – Level 03

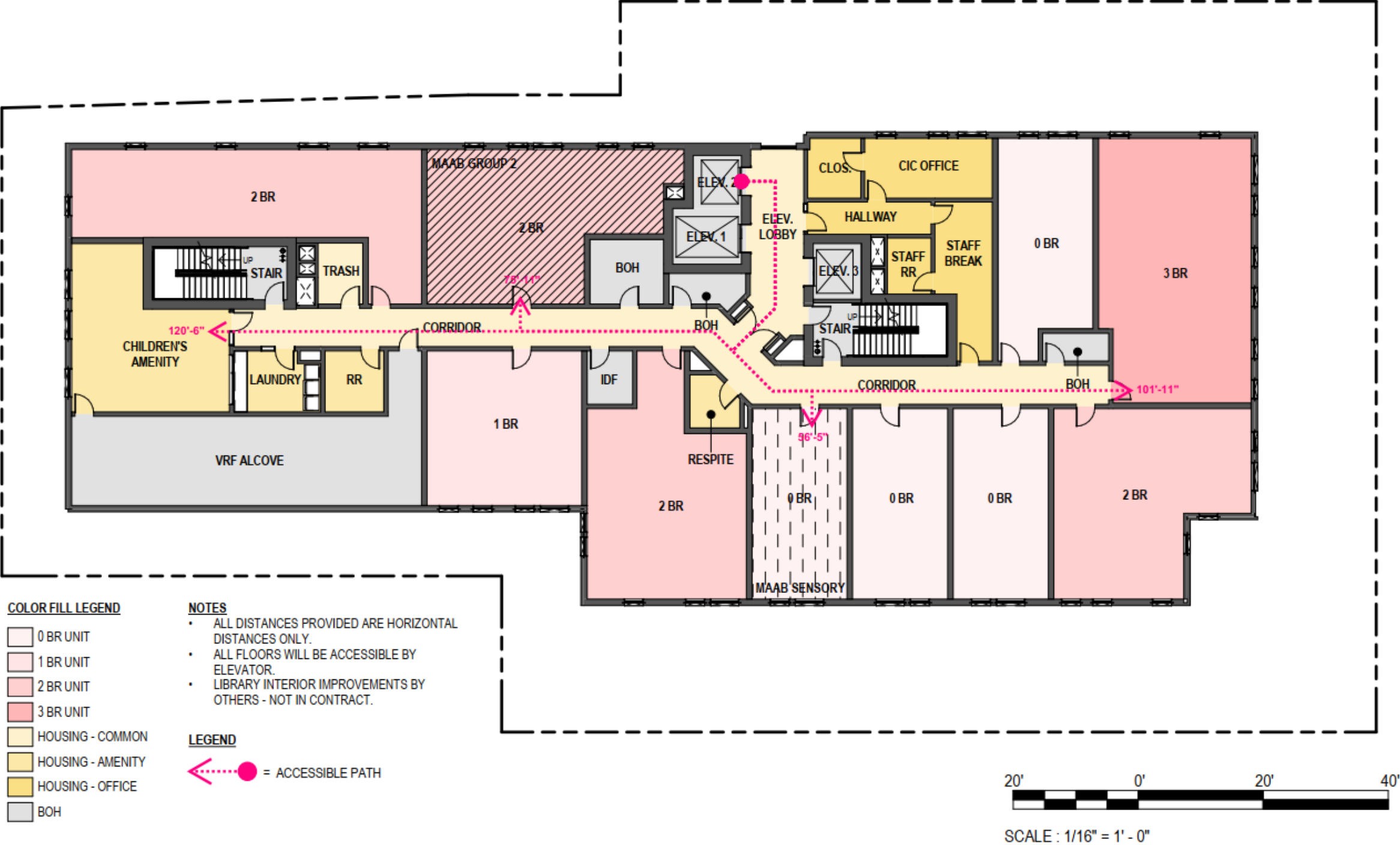
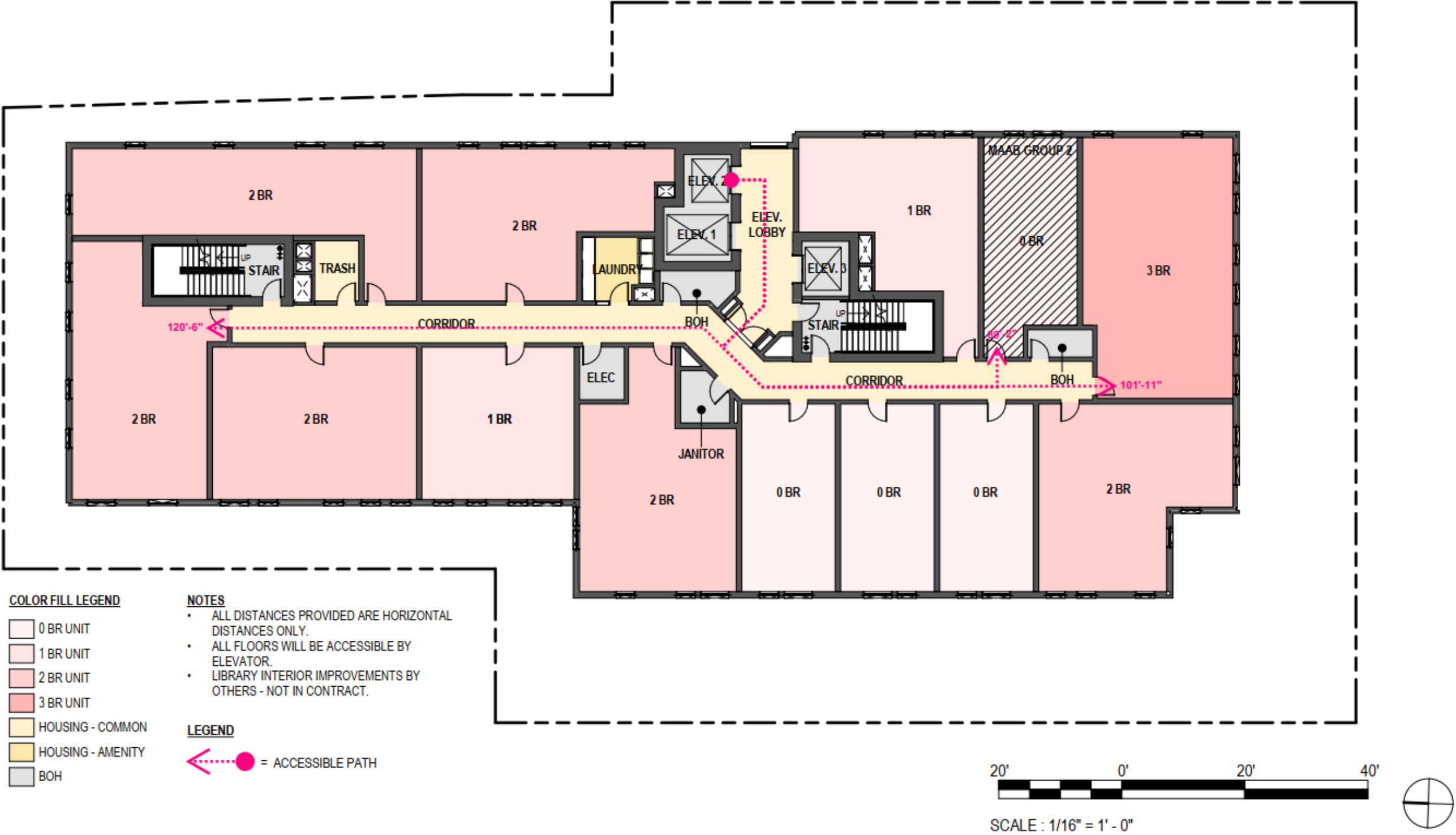


Figure 3-52 Accessibility Plan – Level 04



WEST END LIBRARY DEVELOPMENT

151 CAMBRIDGE ST | DEC 2024 | POAH & CASTE CAPITAL |

ACCESSIBILITY PLAN - LEVEL 04

FIGURE 3-52

MASS. tat



Figure 3-53 Accessibility Plan – Level 05

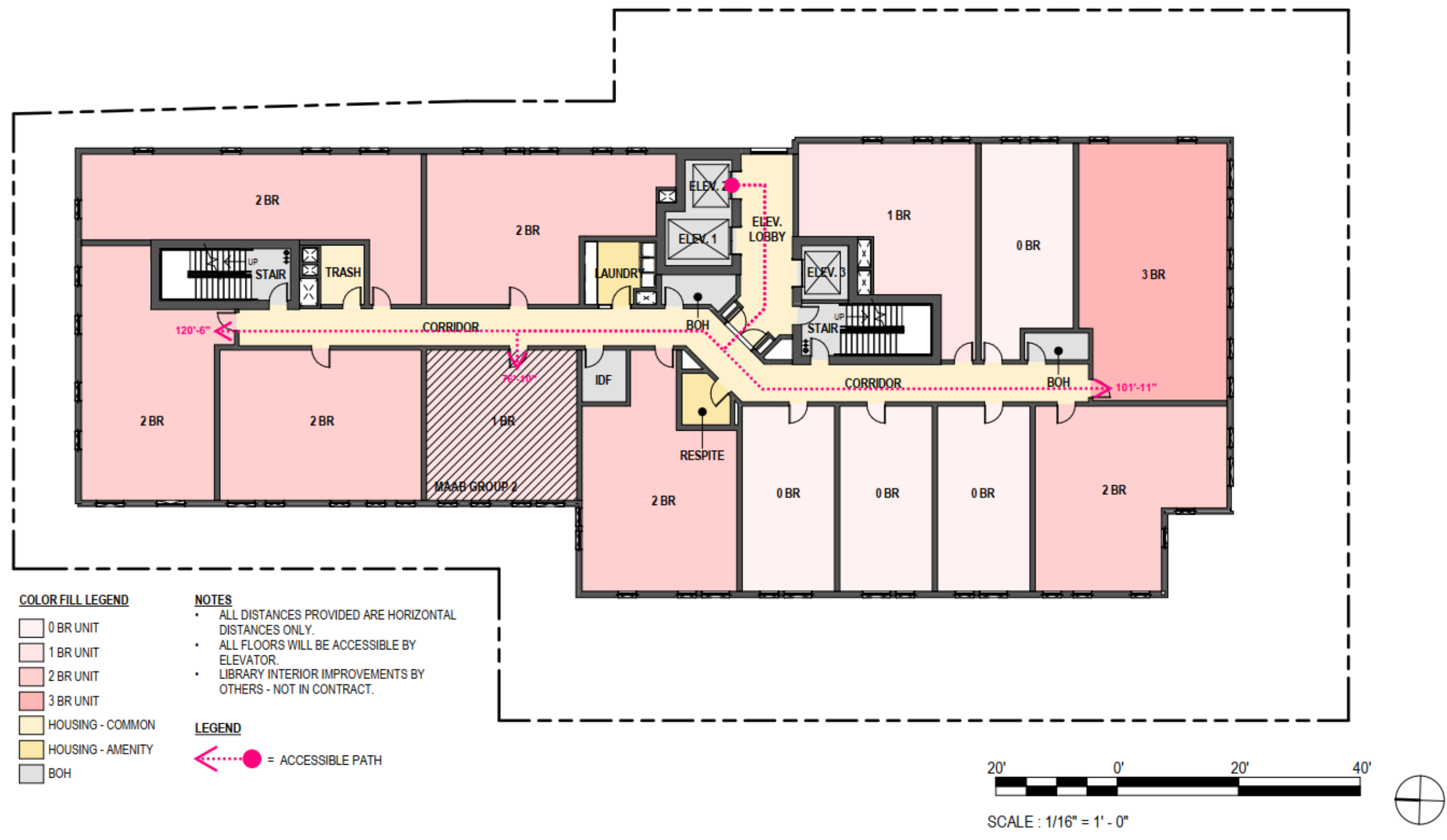


Figure 3-54 Accessibility Plan – Level 06

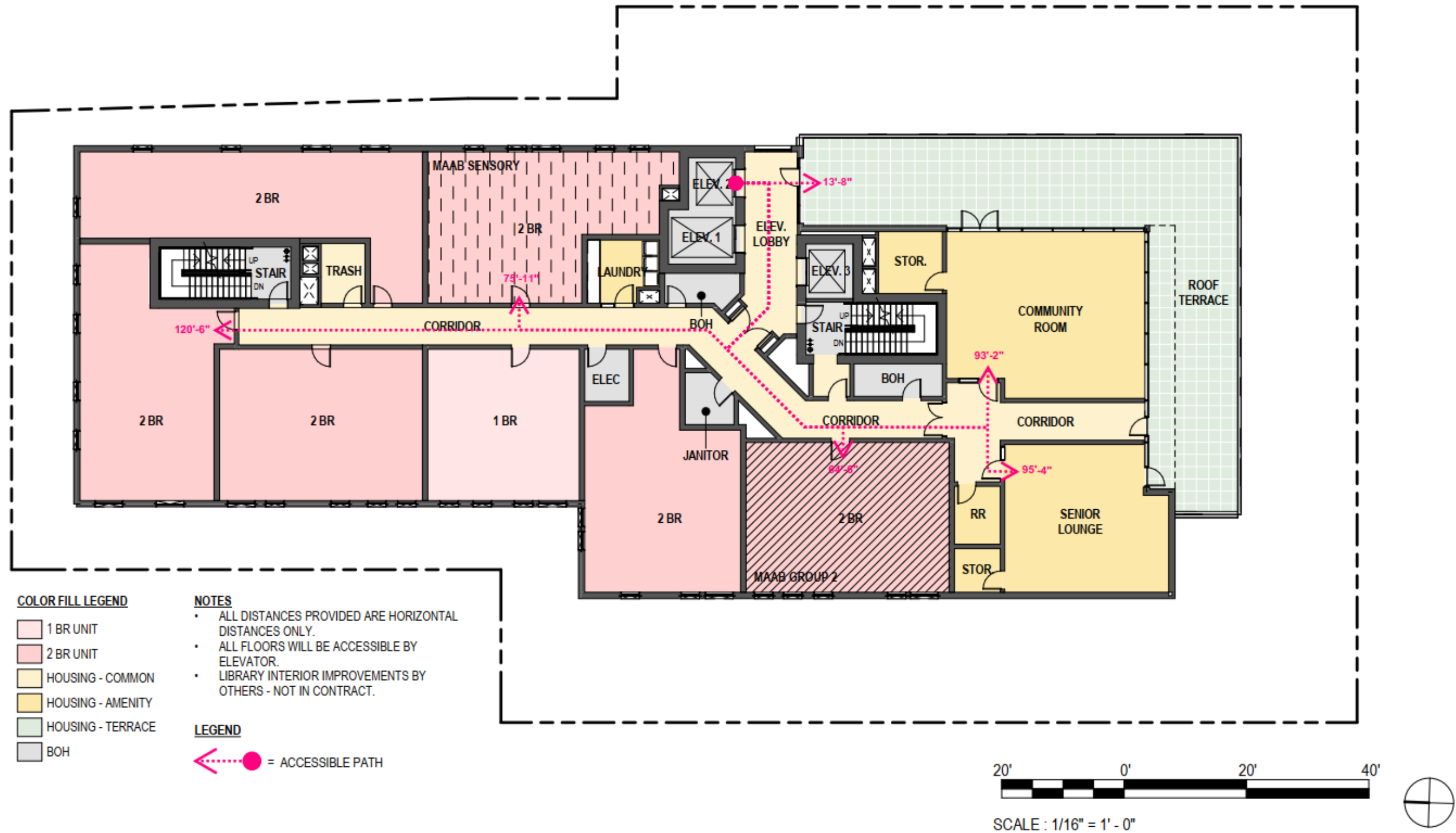


Figure 3-55 Accessibility Plan – Level 07

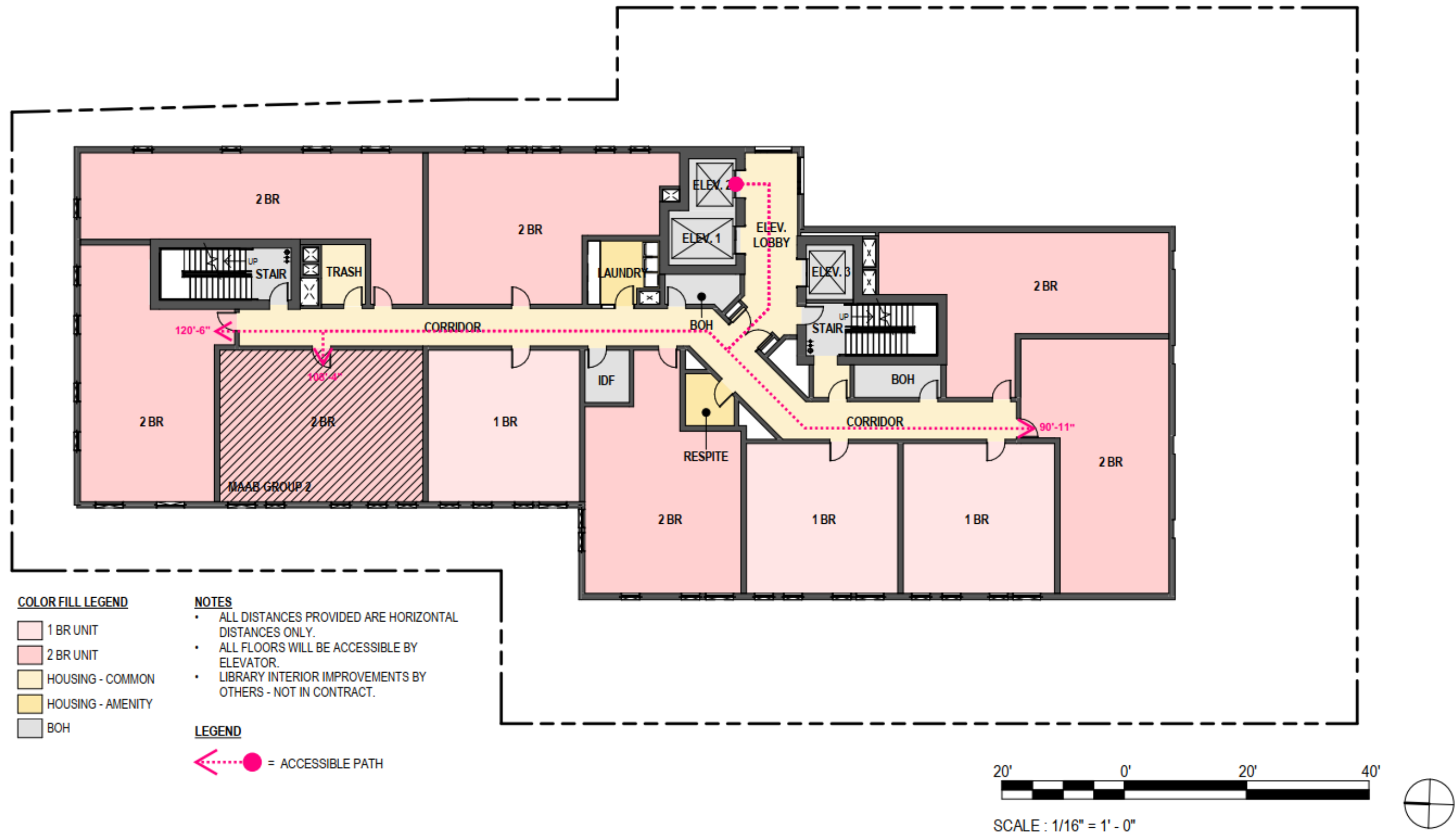


Figure 3-56 Accessibility Plan – Level 08

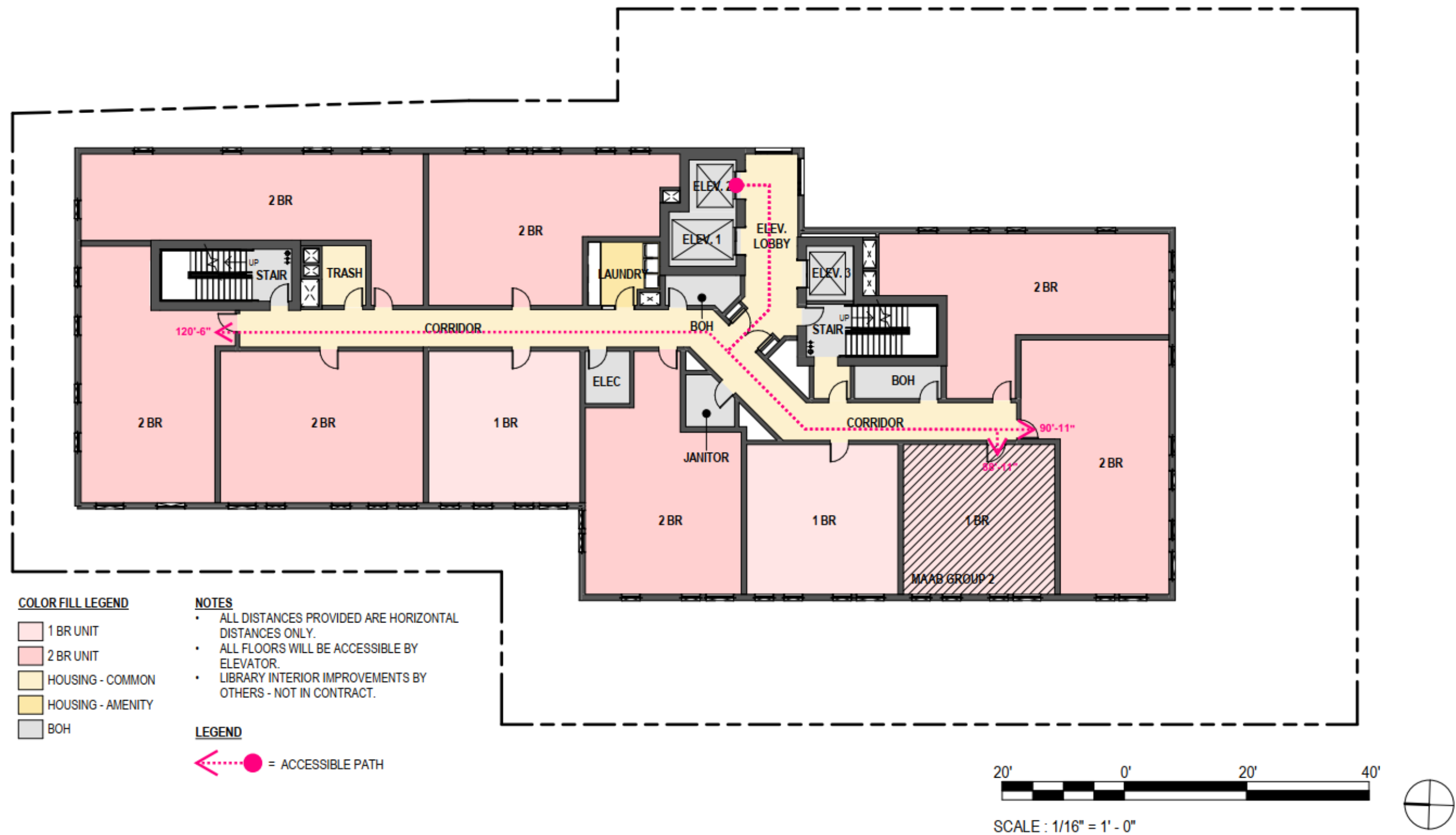




Figure 3-57 Accessibility Plan – Level 09

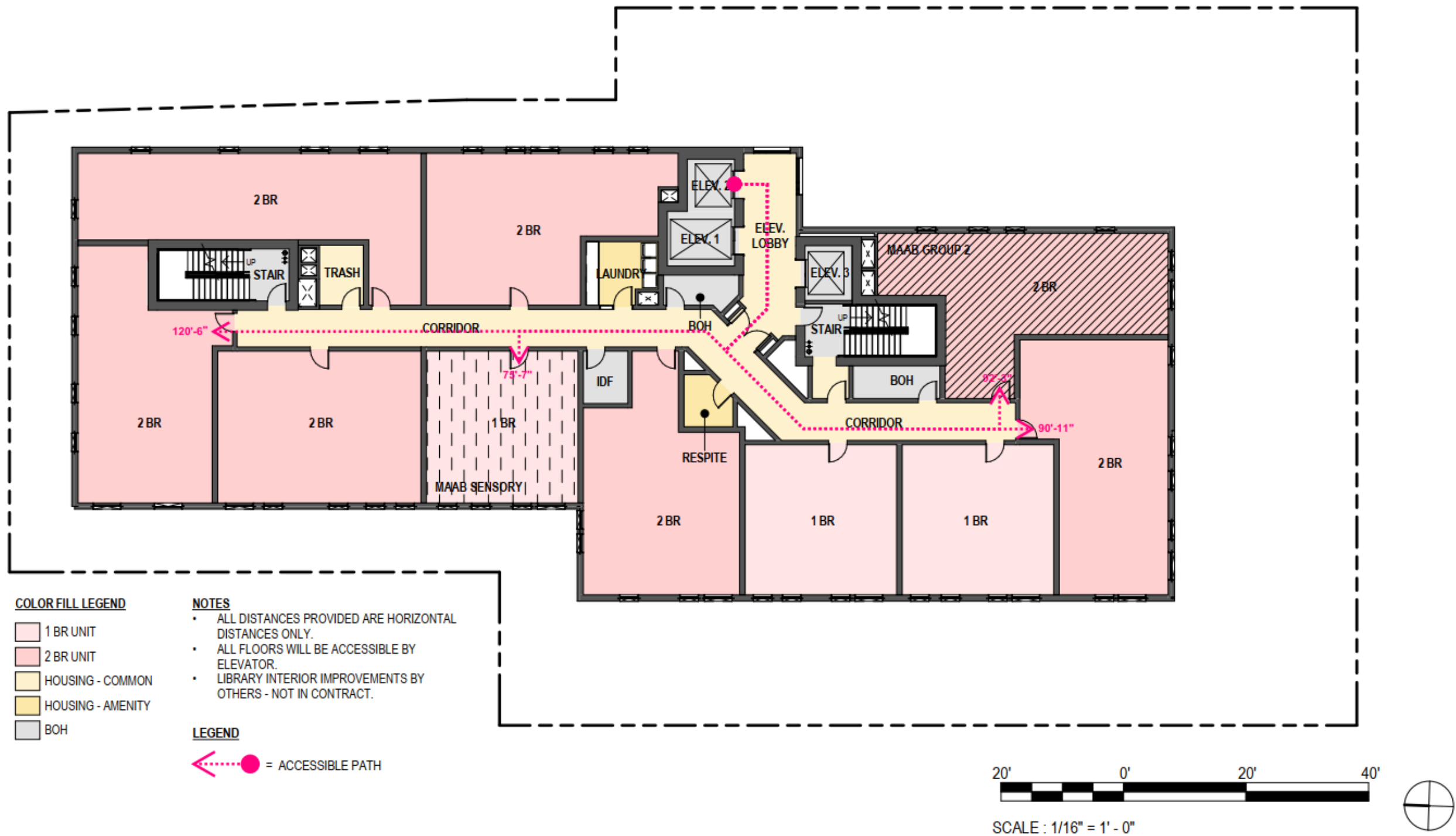


Figure 3-58 Accessibility Plan – Level 10

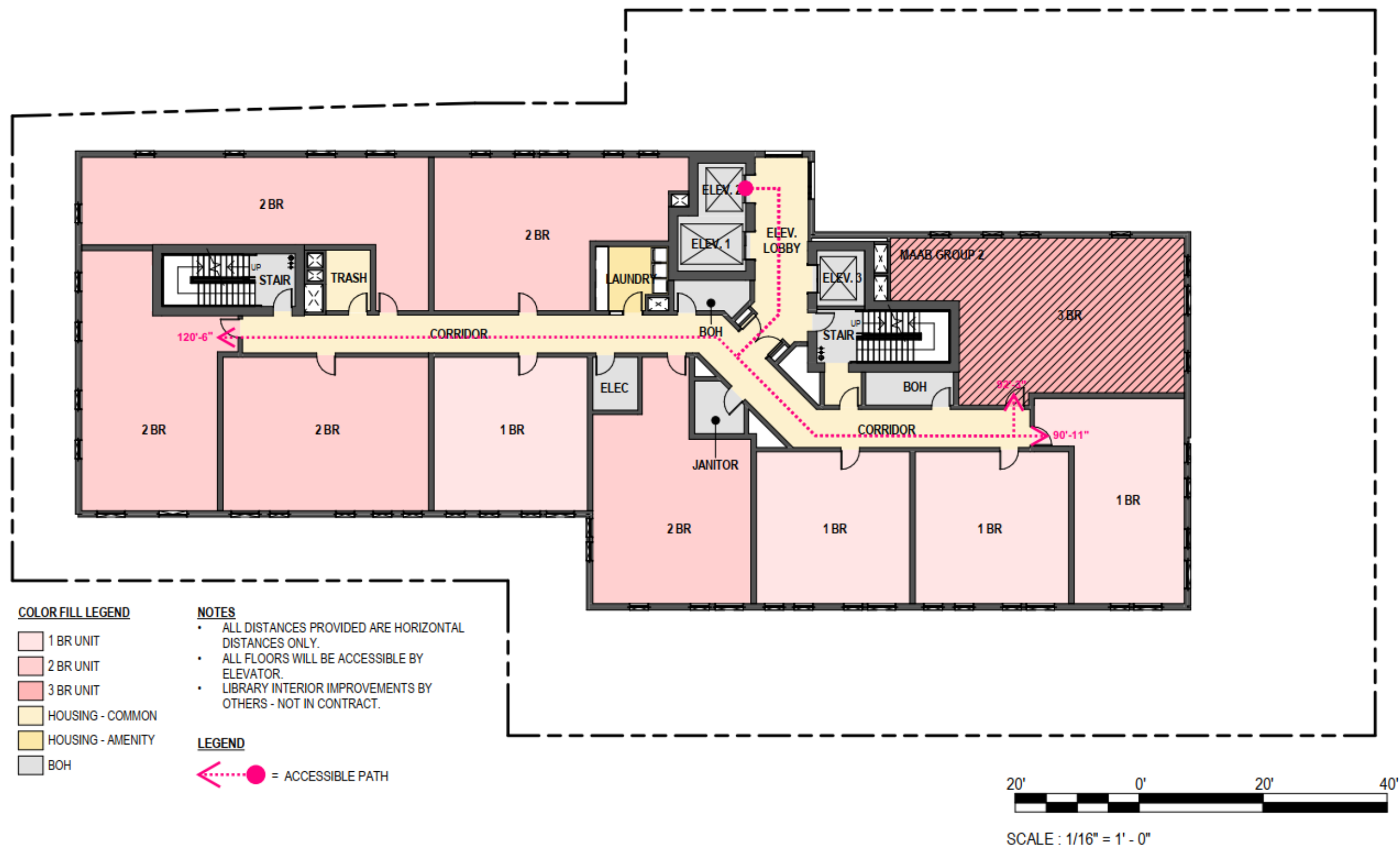


Figure 3-59 Accessibility Plan – Level 11

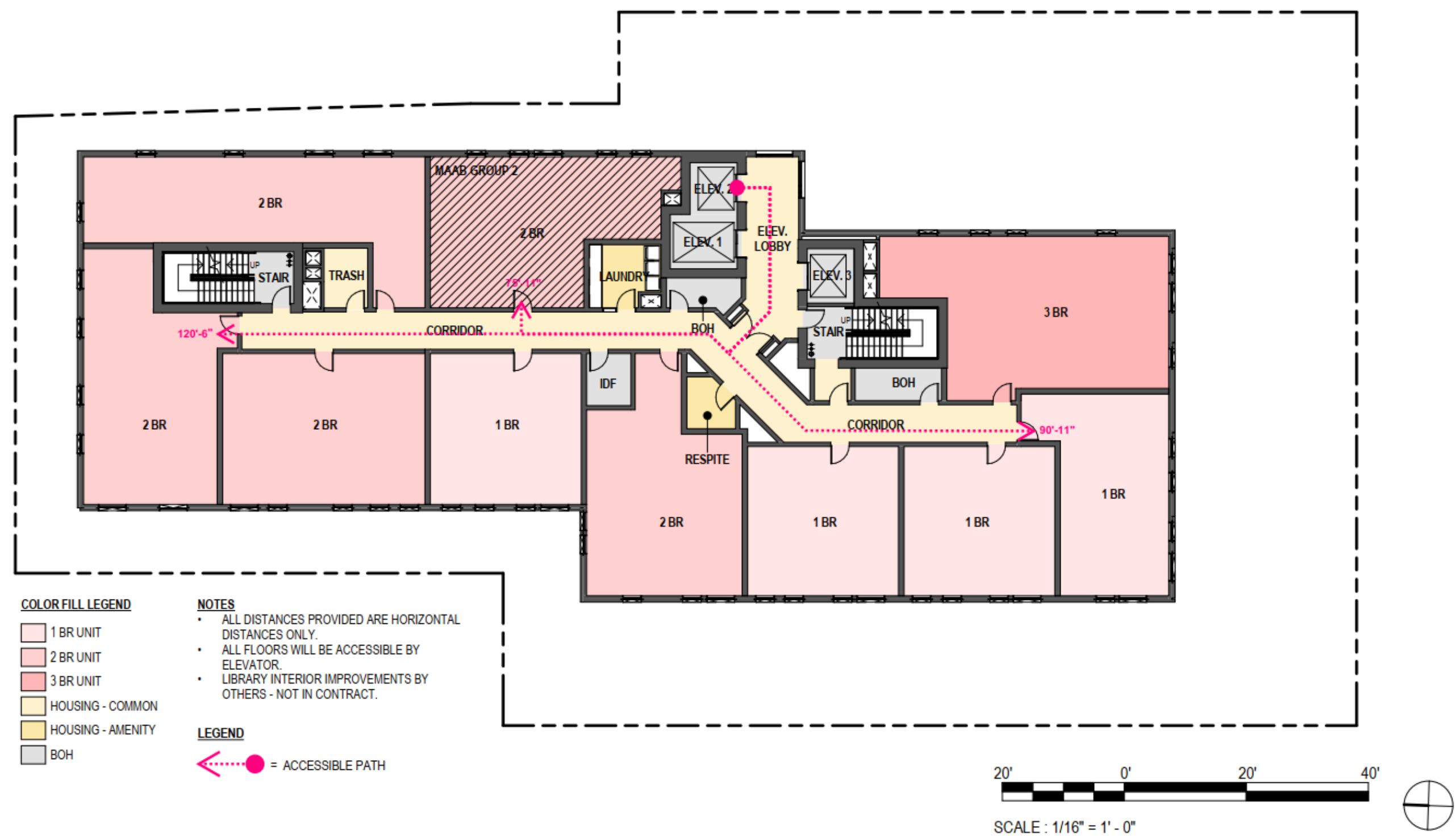


Figure 3-60 Accessibility Plan – Level 12

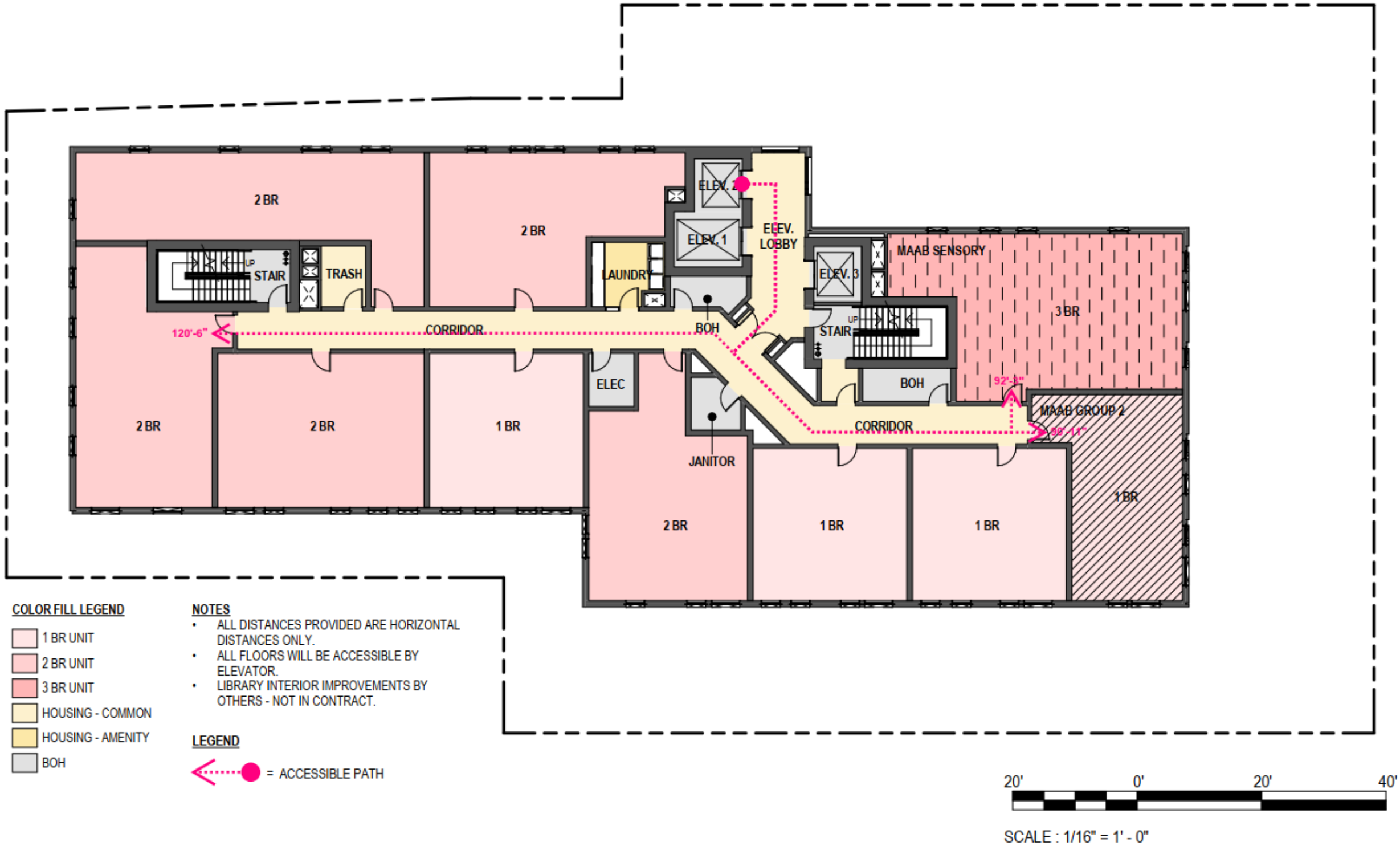




Figure 3-61 Accessibility Plan – Level 13

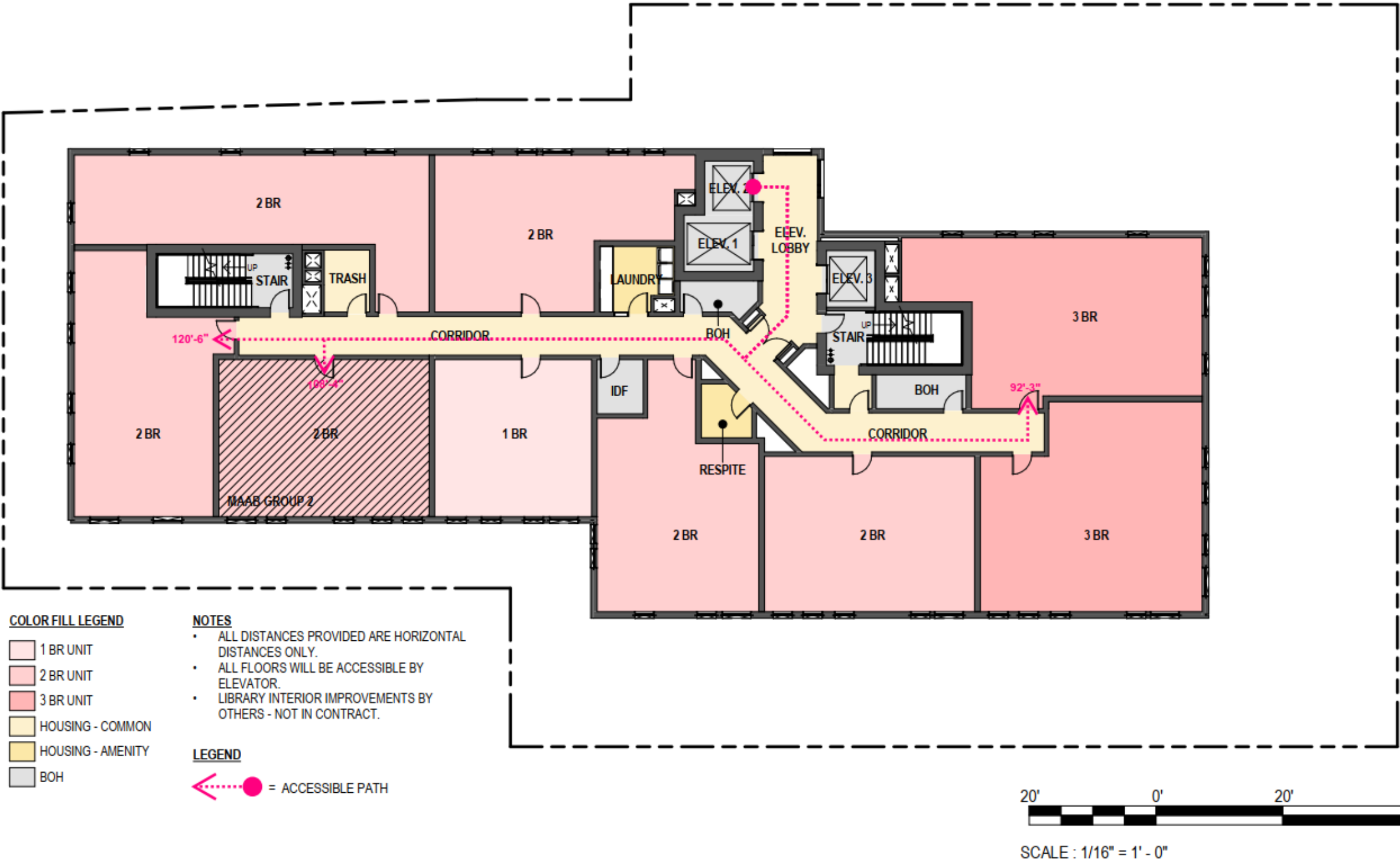
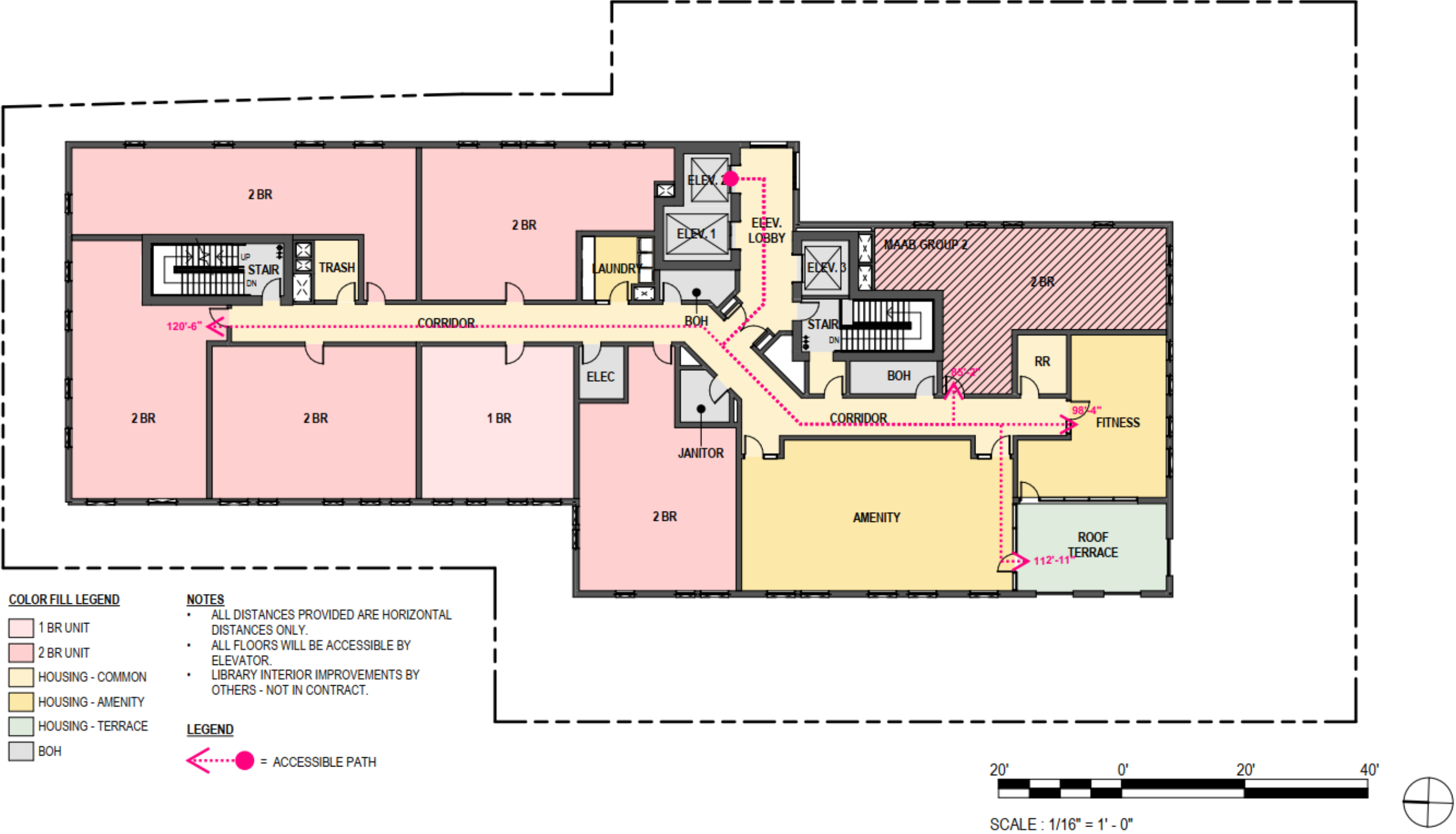


Figure 3-62 Accessibility Plan – Level 14



## **4. Transportation**

### **4.1 Introduction**

This chapter provides an evaluation of the existing and future transportation conditions within the study area of the Proposed Project. This transportation study responds to scoping communication with the City of Boston Planning Department and the Boston Transportation Department (BTD) from September 2024. The study uses standard methodologies, including the Institute of Transportation Engineers (ITE) Trip Generation Manual (11th Edition) and local travel characteristics as defined in Access Boston 2000-2010 and the Go Boston 2030 Transportation Plan.

As described below, the Proposed Project is expected to have a minimal impact on the area's peak period traffic operations. The following are key findings and benefits related to transportation in connection with the Proposed Project:

- The Proposed Project site is located within the West End neighborhood of Boston with local access to the Blue Line; it is also within a reasonable walking distance to the Green Line and Orange Line via Haymarket and North Station as well as Commuter Rail service at the latter. The Project Site is also accessible via a short walk from the Red Line at Charles/MGH Station.
- Traffic generated by the Proposed Project will have no material impacts to the surrounding transportation network.
- In total, the Proposed Project is projected to generate approximately +3 net-new vehicle trips during the weekday morning and approximately +5 net-new vehicle trips during the weekday evening peak hours.
- Loading and service will be managed within a designated curbside loading zone along Cambridge Street. Tenant move-ins will be coordinated and scheduled to limit the number of moving trucks that need to access the Project Site at once.
- Two (2) existing street parking spaces along Cambridge Street will be replaced with a designated loading zone totaling up to 40-feet.
- The Proposed Project will not construct any new parking on-site. The Proponent has held discussions with HNE, the owner of the Otis House, and has confirmed that HNE is

amenable to the removal of the existing 14 surface parking spaces, resulting in a net-reduction of 14 parking spaces within the Project Site. The Proponents will continue to collaborate with HNE to coordinate this matter.

- The Proposed Project improves the existing conditions by enhancing the public realm and providing new street trees, widened sidewalks, and other streetscape amenities to improve and enhance the pedestrian landscape and experience.
- Up to approximately 128 long-term and 32 short-term bike parking spaces will be provided, in accordance with the City’s guidelines; and
- The Proposed Project will implement a proactive TDM plan with specific measures to promote and encourage residents and visitors to use sustainable transportation modes.

**4.2 Project Description**

The Project Site is located within the West End neighborhood of Boston at 151 Cambridge Street. It is generally bounded to the west and north by Mass General Hospital property, to the south by Cambridge Street and to the east by the Otis House. Currently, the Project Site consists of the existing single-story West End Branch of the BPL.

The Proposed Project consists of the construction of a new approximately 176,000 square foot mixed-use building containing approximately 119 income-restricted apartment units and a BPL branch library on the lower two levels of the building. The Proposed Project does not provide any on-site vehicle parking but will include up to approximately 160 bicycle parking spaces. [Table 4-1](#) presents a summary of the proposed development program. See [Figure 4-1](#) for a Context Site Plan.

*Table 4-1 Proposed Development Program*

Land Use	Existing Site	Proposed Project (Approximations)	Change
Residential	-	119 units	+119 units
Library Branch	7,240 sf	19,000 sf	+11,760 sf
Vehicle Parking	14 spaces	0 spaces	-14 spaces
Bicycle Parking		Up to	
Long-term secure spaces	-	128 spaces	+128 spaces
Short-term public spaces	-	32 spaces	+32 spaces



### 4.3 **Study Methodology**

The analysis presented in this chapter provides a detailed description of the Proposed Project's transportation characteristics and evaluates key impacts to the transportation infrastructure. The transportation analysis presented in this chapter conforms to BTB Guidelines, and a scoping discussion with BTB staff on September 26, 2024.

The transportation analysis includes the projection of Project-related trips based on the ITE Trip Generation Manual (11<sup>th</sup> Edition) and the application of local travel characteristics as outlined in Access Boston 2000-2010 and Go Boston 2030. Synchro 11 software was used to facilitate the evaluation of traffic operations based on the Transportation Research Board's Highway Capacity Manual (HCM) methodologies.

This study was conducted in two distinct stages. The first stage (Existing Conditions) involved a survey and compilation of existing transportation conditions within the study area. In line with current BTB guidance, this study relies on volumetric data collected in September 2022, June 2021, and August 2018. Accordingly, [Section 4.4](#) below outlines elements including:

- An inventory of the transportation infrastructure within the defined study area for the Proposed Project;
- Geometric and operational characteristics of study area roadways and intersections;
- Existing traffic control at study area intersections;
- Area off-street and on-street parking supply;
- Pedestrian activity along study area roadways and at study area intersections;
- Inventory of crashes at study area intersections for the latest 3 years available;
- Bicycle activity and accommodations;
- Public transportation options within the study area; and
- Loading and service operations.

In the second stage of the study (Evaluation of Long-Term Transportation Impacts), future transportation conditions were defined within the study area (see [Section 4.5](#) below). The evaluation of future conditions describes the proposed site access and circulation, loading and service strategy, bicycle and pedestrian accommodations, and estimated trips generated by the Proposed Project, in the context of ongoing local transportation initiatives and development.

#### **4.3.1 Traffic Study Area**

Based on the Proposed Project's development program and the surrounding vehicular network, three study area intersections were determined appropriate for evaluation. As shown in [Figure 4-2](#), the following intersections were included in the study area:

- Cambridge Street at Staniford Street/Temple Street (signalized)
- Cambridge Street at Joy Street (signalized)
- Cambridge Street at Blossom Street/Garden Street (signalized)

#### **4.4 Existing Conditions**

This section includes descriptions of existing study area roadway geometry, intersection geometry, curb usage (parking), public transit availability, pedestrian, and bicycle facilities, and peak-hour traffic volumes for vehicles, bicycles, and pedestrians.

##### **4.4.1 Existing Roadway Condition**

The Project Site is located within the West End neighborhood at 151 Cambridge Street. The Proposed Project is serviced by an extensive roadway network as outlined below.

Cambridge Street is a two-way urban principal arterial that runs in a general east/west direction. Cambridge Street connects Tremont Street at the intersection with Court Street east of the Proposed Site to Longfellow Bridge west of the Project Site at the intersection with Charles Street. The roadway generally provides two vehicular travel lanes in each direction with parking generally provided on both sides of the roadway and a buffered bike lane for parts of Cambridge Street. Crosswalks are provided at signalized intersections and sidewalks are provided along both sides of the street.

Staniford Street is an urban principal arterial that starts near Lomasney Way/Merrimack Street to Beach Street running in the north/south direction. The street provides two travel lanes per direction, with on-street parking on a section of the southbound side and a two-way bike facility along the northbound side. Crosswalks are provided at intersections, and sidewalks are present along both sides of the street.

Temple Street is a one-way northbound local roadway that begins at Cambridge Street and terminates at Derne Street. It runs in the north/south direction with a single travel lane.

Parking is prohibited on both sides of the street. Brick-clad crosswalks are provided at intersections, and sidewalks are present along both sides of the street.

Joy Street is a one-way local roadway that provides northbound travel between Cambridge Street to Mt. Vernon Street and southbound travel from Mt. Vernon to Beacon Street. Crosswalks are provided at major intersections and sidewalks are present along both sides of the street.

Blossom Street is a two-way local roadway running in the east/west direction from Charles Street to Blossom Court before transitioning to a north/south orientation. Parking is generally provided on both sides of the street. Crosswalks are provided on major crosswalks and sidewalks are present on both sides of the roadway.

Garden Street is a local roadway that connects Cambridge Street to Myrtle Street, providing one-way northbound travel. Parking is generally provided on the east side of the roadway. Crosswalks are provided at intersections and sidewalks are present along both sides of the street.

#### **4.4.2 Existing Parking and Curb Use**

An inventory of the on-street parking and curb use within a quarter-mile radius of the Project Site was collected in October 2024. Findings show that curb regulations along Cambridge Street in the vicinity of the Project Site primarily consist of two-hour parking and accessible parking. Time-specific pick-up/drop-off and loading zones are present on the eastbound side of Cambridge Street. On local side streets near the Project Site, resident permit parking is provided. A map of curb regulations is presented as [Figure 4-3](#). The existing off-street public parking options in the surrounding area are also illustrated in [Figure 4-4](#).

#### **4.4.3 Car Sharing Services**

Car sharing services enable easy access to short-term vehicular transportation. Vehicles are rented on an hourly or daily basis, and all vehicle costs (gas, maintenance, insurance, and parking) are included in the rental fee. Vehicles are checked out for a specific period and returned to their designated location. Pick-up/drop-off locations are typically in existing parking lots or other parking areas throughout neighborhoods as a convenience to users.

Nearby car sharing services provide an important transportation option and reduce the need for private vehicle ownership.

Zipcar is the primary company in the Boston car sharing market. However, other companies such as Turo and Getaround also operate within the city. There are currently three Zipcar locations within a five-minute walk (one-quarter mile) of the Project Site. The nearby car sharing locations are shown in [Figure 4-5](#).

#### **4.4.4 Existing Vehicular Access**

Currently, there are two existing surface lots on the Project Site providing a total of 14 vehicle parking spaces accessed via a curb cut/driveway off Cambridge Street. The existing parking serves the existing West End Library Branch and the Otis House. The Proponent has held discussions with HNE and has confirmed that HNE is amenable to the removal of the existing surface parking to establish an enhanced public realm between the Project Site and the Otis House. The Proponent will continue to collaborate with HNE to coordinate this matter.

#### **Data Collection**

Turning movement counts (TMCs), including vehicles, pedestrians, and bicycles, were provided by the BTM for the designated study area intersections. Counts were conducted in August 2018 between 7:00 AM - 7:00 PM. Consistent with Massachusetts Department of Transportation (MassDOT) and BTM guidelines, no growth adjustments were applied to the historic volumes. The resulting morning and evening 2024 Baseline Condition peak hour vehicle volumes at study area intersections are presented in [Figure 4-6](#) and [Figure 4-7](#). The detailed traffic counts will be provided upon request.

#### **4.4.5 Existing Pedestrian Condition**

Currently, the West End Library Branch main entrance is located on Cambridge Street, with a secondary access on the back of the building connecting the library to one of the surface parking lots at the Project Site.

As noted previously, sidewalks are provided along both sides of all study area roadways and are generally in a fair condition due to construction or wear and tear. Crosswalks and pedestrian signal equipment, including pedestrian push buttons are provided at all signalized intersections.



The City of Boston conducts annual compliance assessments for its pedestrian ramps, evaluating them based on dimensions, crosswalk alignment, and overall condition. As of the 2022 city inventory<sup>1</sup>, most pedestrian ramps within the study area were found to be non-compliant with accessibility standards.

To determine the amount of pedestrian activity within the study area, pedestrian counts were obtained concurrently with vehicle TMCs in August 2018. Consistent with MassDOT and BTG guidelines, no growth adjustments were applied to the pedestrian volumes. [Figure 4-8](#) and [Figure 4-9](#) demonstrate the 2024 Baseline Condition pedestrian volumes for the morning and evening peak hours, respectively.

The busiest study area intersection during the morning peak hour was Cambridge Street at Blossom Street, where there were approximately 1,554 pedestrians, and Cambridge Street at Staniford Street in the evening peak hour where 1,660 pedestrians were counted crossing the intersection.

#### **4.4.6 Existing Bicycle Environment**

Bicycle volumes at study area intersections, demonstrated in [Figure 4-10](#) and [Figure 4-11](#), were collected concurrently with the vehicle TMCs and pedestrian counts.

On Cambridge Street, buffered bike lanes are provided in the westbound travel lane connecting bicyclist from the West End neighborhood to the Longfellow Bridge and into

Cambridge. Staniford Street offers a two-way bike facility along the east/northbound side of the roadway, providing a safe and comfortable ride for users. The existing library building does not offer any bike parking spaces on-site.

The busiest study area intersection was Cambridge Street at Blossom Street in the morning peak hour where 206 cyclists were counted, and Cambridge Street at Staniford Street during the evening peak hour where 269 cyclists were counted. Furthermore, the following Bluebikes stations are provided within a quarter mile of the Project Site:

- Cambridge Street at Joy Street (15 Docks)

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<sup>1</sup> City of Boston Ramp Condition and Repair Reporting June 2023, accessed September 10, 2024 - [City of Boston Ramp Condition and Repair Reporting \(arcgis.com\)](#)

- Staniford Street at Merrimac Street (23 Docks)

As seen in [Figure 4-12](#), the closest Bluebikes station is located at Cambridge Street at Joy Street, just across the street from the Project site.

#### **Bluebikes Station Utilization Analysis**

Historical data were used to assess the utilization of the two stations closest to the Project Site on a typical weekday. Trip data were downloaded from the Bluebikes website for the month of October 2024. Wednesday, October 16, 2024, was selected as a typical commuting day to avoid holidays or public transit shutdowns which may affect travel patterns. [Table 4-2](#) shows the number of trips originating and terminating at each of three Bluebikes stations within a quarter mile radius of the Project Site.

**Table 4-2 Summary of Bluebikes Utilization – Fall 2024**

Time	Cambridge Street at Joy Street		Staniford Street at Merrimac Street	
	Originating at Station	Ending in Station	Originating at Station	Ending in Station
7:00 AM	3	8	1	1
8:00 AM	13	8	5	0
9:00 AM	7	5	1	1
10:00 AM	2	4	1	0
11:00 AM	10	7	0	0
12:00 PM	1	2	1	0
1:00 PM	4	4	0	3
2:00 PM	3	8	1	1
3:00 PM	7	3	2	1
4:00 PM	9	11	0	4
5:00 PM	8	8	2	2
6:00 PM	8	7	2	3
Total	75	75	16	16

*Source: Bluebikes.com – October 2024, accessed December 13, 2024.*

As shown in the table above, a total of 91 Bluebikes trips originated and 91 Bluebikes trips ended at the two stations closest to the Project Site during a 12-hour period. It is

anticipated that the existing stations can sufficiently accommodate bike sharing demand in the area.

#### 4.4.7 Existing Public Transit

The Project Site is currently served by several MBTA public transportation services, as demonstrated in [Figure 4-13](#). The details related to transit services available around the Project site including line, route information, stations adjacent to the Project Site, and peak period headways are summarized in [Table 4-3](#).

**Table 4-3 Existing Public Transportation**

Transit	Route Service	Closest Station to Site	Distance to Site (miles)	Peak-Hour Headway*
<u>Subway/Light Rail</u>				
Blue Line	Wonderland/Bowdoin	Bowdoin	0.1	4 - 5 minutes
Red Line	Alewife/Ashmont/Braintree	Charles/MGH	0.3	6 - 10 minutes
Green Line	Riverside/Cleveland Circle/ Boston College/Heath Street/ Union Square/Medford/Tufts	Government Center	0.3	6 - 8 minutes
Orange Line	Oak Grove/Forest Hills	Haymarket	0.4	6 - 9 minutes

Source: MBTA Winter 2025 Schedule (Effective December 15, 2024) \*Headway is the time between service

#### 4.4.8 Crash Analysis

A detailed crash analysis was conducted to identify potential vehicle accident trends and roadway deficiencies in the traffic study area. The most current vehicle accident data for the traffic study area intersections were obtained from MassDOT and the Massachusetts Registry of Motor Vehicles (RMV) Division for the years 2018 to 2021 and supplemented with data from the BTD Vision Zero Crash Data Portal. Data from the year 2020 is excluded from any general analysis of the study area intersections to retain consistency with typical movement trends and remove covid-era impacts. The MassDOT database is comprised of crash data from the RMV primarily for use in traffic studies and safety evaluations.

Crash rates are calculated based on the number of accidents at an intersection and the volume of traffic travelling through that intersection daily. Rates that exceed MassDOT's average for crashes could indicate safety or geometric issues for an intersection. As Boston is in MassDOT's District 6, the calculated crash rates were compared to those of MassDOT District 6, which are 0.71 for signalized intersections and 0.52 for unsignalized intersections. These rates imply that, on average, 0.71 accidents occurred per million entering signalized intersections throughout District 6, and 0.52 accidents occurred per million vehicles entering unsignalized intersections.

Review of the accident data indicates that all study area intersections are below the district crash rate averages. The intersection of Cambridge Street at Staniford Street/Temple Street has the highest number of crashes in the study area with a total of five crashes over the three-year period. One of the five crashes at the intersection involved non-motorists (e.g., pedestrians and bicyclists).

**Table 4-4 MassDOT Vehicular Crash Summary (2018-2021)**

Intersection Number	1	2	3
	Cambridge St at Staniford St / Temple St	Cambridge St at Joy St	Cambridge St at Blossom St /Garden St
Signalized?	Yes	Yes	Yes
MassDOT Average Crash Rate	0.71	0.71	0.71
Calculated Crash Rate	0.21	0.00	0.00
Exceeds Average?	No	No	No
Year			
2018	3	0	0
2019	2	0	0
2021	0	0	0
Total	5	0	0
Time of Day			
Weekday, 7 AM - 9 AM	2	0	0
Weekday, 4 PM - 6 PM	1	0	0
Saturday, 11 AM - 2 PM	0	0	0
Weekday, other time	1	0	0
Weekend, other time	1	0	0
Non-motorist (Bicycle, Pedestrian)	1	0	0

*Source: Crash data was obtained from MassDOT Crash Portal (2018-2021). Accessed on October 7, 2024.*



Data files are provided for an entire year, though it is possible that some crash records may be omitted either due to individual crashes not being reported, or the city crash records not being provided in a compatible format for RMV use. It has been recognized that MassDOT crash reporting may not fully account for all crashes reported in the Boston Police Department (BPD) or Boston Emergency Medical Services (EMS) due to an inconsistency in the reporting format used by the BTM.

For an additional representation of roadway safety, crash data was downloaded from the Vision Zero database. A summary of vehicle accident history based on the available Vision Zero data is included in [Table 4-5](#). Although limited information is available for each individual crash, the supplemental data is presented to help represent the overall crash characteristics in the area. Note that some data points were omitted to prevent duplicates, as they are captured by the MassDOT data in [Table 4-4](#).

**Table 4-5 Vision Zero Vehicular Crash Summary (2018-2021)**

Intersection Number	1	2	3
	Cambridge St at Staniford St / Temple St	Cambridge St at Joy St	Cambridge St at Blossom St /Garden St
2018	2	0	2
2019	1	0	1
2021	2	0	1
Total	5	0	4
Mode			
Motor Vehicle	5	0	0
Pedestrian	0	0	2
Bicycle	0	0	2

*Source: Crash data was obtained from BTM Vision Zero Crash Records. Accessed on October 10, 2024.*

### **Highway Safety Improvement Plan (HSIP)**

Additionally, the study area intersections were compared to the MassDOT Highway Safety Improvement Plan (“HSIP”) map of the Commonwealth’s top crash locations. None of the study area intersections were identified as top crash locations by MassDOT.

## **4.5 Future (2027) Conditions**

As previously summarized, the Proposed Project will include the construction of a new 14-story building. The Proposed Project will provide approximately 119 residential units and an approximately 19,000-square-foot BPL branch library on the lower two levels, with no on-site vehicle parking. This section will describe the Proposed Project's future transportation impacts in the context of ongoing transportation initiatives and improvements.

### **4.5.1 Site Access and Circulation**

The site plan for the Proposed Project is shown in previous chapters.

#### **Pedestrian and Bike Access**

Pedestrian access to the residential lobby will be provided on Cambridge Street through the eastern most main entrance. The dedicated library entrance is provided through a separate entrance facing Cambridge Street. The eastern most portion of this building entry provides an accessible, sidewalk level entrance which slopes up going west. The western most edge is supplemented with stairs.

Pedestrian pick-up/drop-off will be restricted to Cambridge Street via a curbside pickup/drop-off zone.

The Proposed Project is also proposing a pedestrian plaza on the eastern side of the Project Site. The plaza will contain outdoor seating area, landscaping, and outdoor bike racks. A pedestrian terrace will be provided on the west side of the proposed building providing additional outdoor seating and community area.

#### **Parking**

As previously mentioned, the Proposed Project will not create any new vehicle parking spaces. The Proponent has held discussions with HNE and has confirmed that HNE is amenable to the removal of the existing surface parking spaces. The Proponent will continue to collaborate with HNE to coordinate this matter.

#### **Loading and Service**

All loading and service operations for the Proposed Project will be accommodated by an on-street loading zone on Cambridge Street along the frontage of the parcel. Two existing on-

street vehicle parking spaces along Cambridge Street, totaling up to 40-feet, will be converted into a passenger/loading zone, in coordination with BTD.

Additional service access will be provided along the east side of the building for transformer and trash services. Access to the dedicated transformer zone will be provided via the existing curb cut along Cambridge Street on a very infrequent basis.

### **Emergency Vehicle Access**

It is anticipated that emergency vehicles will access the proposed building from Cambridge Street.

### **Bicycle Accommodations**

BTB has established guidelines requiring projects subject to Transportation Access Plan Agreements (TAPAs) to provide secure bicycle parking for residents. In accordance with BTB guidelines, the Proposed Project will supply up to approximately 128 secure long-term bicycle storage spaces. Additionally, up to approximately 32 short-term bike parking will be provided with outdoor bicycle racks accessible to visitors of the Project. [Table 4-6](#) shows the proposed bicycle parking program.

The Proposed Project will provide a bike room in the basement of the building to serve residents and library visitors. Access to the bike room will be provided via double-doors and a bike-sized elevator with access from the plaza along the east side of the building.

**Table 4-6 Proposed Bicycle Parking Program**

Land Use	Program (Approx.)	Long Term Bike Parking Ratio	Minimum Long-Term Bike Parking (Approx.)	Short-Term Bike Parking Ratio	Minimum Short-Term Bike Parking (Approx.)
Residential	119 units	1 space per unit	120 spaces	1 space per 5 units	24 spaces
Library (Institutional)	19,000 sf	1 space per 2,500 sf	8 spaces	1 space per 2,500 sf	8 spaces
<b>Total</b>			<b>128 spaces</b>		<b>32 spaces</b>

*Source: BTB Bike Parking Guidelines (version 2.1), January 2021*

### **4.5.2 Trip Generation Methodology**

Determining the future trip generation of the Proposed Project is a complex, multi-step process that produces an estimate of vehicle trips, transit trips, walk trips, and bicycle trips associated

with a proposed development and a specific land use program. A project's location and proximity to different travel modes determines how people will travel to and from the Project Site.

To estimate the number of trips expected to be generated by the Proposed Project, data published by the Institute of Transportation Engineers (ITE 11<sup>th</sup> Edition) in the Trip Generation Manual<sup>2</sup> were used. ITE provides data to estimate the total number of unadjusted vehicular trips associated with the Proposed Project. In an urban setting well-served by transit, adjustments are necessary to account for other travel mode shares such as walking, bicycling, and transit.

To estimate the unadjusted number of vehicular trips for the Project ITE land use code LUC222 – Multifamily Housing (High-Rise) (average rate per unit), was utilized.

To estimate the trip generation of the library component of the Proposed Project, data provided by the BPL were used, for comparable existing branch locations situated among a similar mixture of commercial and residential establishments. Furthermore, VHB collected entry and exit data on July 21, 2022, at the Chinatown library branch, which (similarly to the proposed development) does not provide parking on-site. The anticipated evening trips to the proposed library branch were calculated as a function of the entry and exit volume at the Chinatown branch and the square footage of the building.

### **Existing Trip Generation**

When assessing a site with existing, active land uses, it is standard practice to estimate existing trips and subtract those trips from the projected new future trips. The result of this process yields “net new” trips that become the basis for traffic analysis.

The Project Site currently contains the existing single-story West End Branch of the BPL. Existing trips associated with the existing library building were estimated using the same empirical data used to estimate the proposed library component generated trips.

### **Travel Mode Share**

This Project Site has multiple public transportation options and is within range to walk and/or bike from the Charlestown, Chinatown, Downtown, and South End neighborhoods. In the Access Boston 2000-2010 study, BTS provides vehicle, transit, and walking mode shares for



different areas of Boston. The Proposed Project is in Zone 1; the mode share splits for residential and work land uses are consistent with this study. Mode share splits for the library land use were determined in coordination with the BPL based on travel patterns at existing urban library branches with no parking on-site. Mode splits by land use are presented in [Table 4-7](#). The unadjusted vehicular trips were converted to person trips by using vehicle occupancy rates published by the Federal Highway Administration (FHWA)<sup>3</sup>.

**Table 4-7 Travel Mode Shares**

Land Use		Walk/Bicycle Share	Transit Share	Auto Share	Vehicle Occupancy Rate <sup>3</sup>
<u>Morning Peak</u>					
Residential <sup>1</sup>	In	20%	71%	9%	1.08
	Out	16%	76%	9%	
Library <sup>2</sup>	In	48%	48%	5%	1.60
	Out	48%	48%	5%	
<u>Evening Peak</u>					
Residential	In	16%	76%	9%	1.08
	Out	20%	71%	9%	
Library	In	48%	48%	5%	1.60
	Out	48%	48%	5%	

*Sources:*

1. Access Boston 2000-2010 Area 3, GoBoston 2030,
2. Boston Public Library data
3. NHTS Summary of Travel Trends 2022 Report

### **Project Trip Generation**

The travel mode share percentages shown in [Table 4-7](#) were applied to the number of person trips to develop walk/bicycle, transit, and vehicle trip generation estimates. Vehicle trips include automobile, taxicabs, and transportation network company (TNC) services such as Uber and Lyft. The trip generation for the Proposed Project by mode is shown in [Table 4-8](#). The detailed trip generation information will be provided upon request.

- 2 Trip Generation Manual, 11th Edition; Institute of Transportation Engineers; Washington, D.C.; 2021.
- 3 Summary of Travel Trends: 2022 National Household Travel Survey; FHWA; Washington, D.C.; July 2018.

**Table 4-8 Project Trip Generation Summary**

Vehicle Trips						
Land Use		Walk/Bike Trips	Transit Trips	Project-Generated Vehicle Trips	Existing Trip Credit	Net-New Vehicle Trips
<u>Morning Peak</u>						
Residential + Library	In	12	6	1	-0	+1
	Out	17	4	2	-0	+2
	<b>Total</b>	<b>30</b>	<b>10</b>	<b>3</b>	<b>-0</b>	<b>+3</b>
<u>Evening Peak</u>						
Residential + Library	In	40	26	3	-1	+2
	Out	54	45	4	-1	+3
	<b>Total</b>	<b>94</b>	<b>71</b>	<b>7</b>	<b>-2</b>	<b>+5</b>

*Note: Trip Generation mode splits align with GoBoston 2030, Boston Public Library data*

The Proposed Project is expected to generate approximately +3 new vehicle trips (+1 entering and +2 exiting) during the weekday morning peak hour and approximately +5 new vehicle trips (+2 entering and +3 exiting) during the weekday evening peak hour. This indicates that during peak hours, the Proposed Project land uses will produce minimal added vehicle trips. The Proposed Project is also expected to generate approximately 30 new peak hour pedestrian/bicycle trips and approximately 10 new peak hour transit trips in the morning peak hour, as well as approximately 94 new peak hour pedestrian/bicycle trips and approximately 71 new peak hour transit trips in the evening peak hour.

#### **4.6 Transportation Demand Management (TDM)**

Consistent with the City's goals to reduce auto-dependency, the Proposed Project and its Proponent will incorporate proactive TDM measures to encourage alternative modes of transportation. The TDM measures are in line with the City's recently published Transportation Demand Management Point System (version 9/21/2021).

An initial list of TDM strategies that are anticipated to be implemented by the Proposed Project are included in [Table 4-9](#).

**Table 4-9 Initial List of TDM Strategies for Project**

Category	Strategy
Baseline Programming	TMA Membership: Join a Transportation Management Association, if available, at the time of Project approval.
	On-Site TDM Coordinator: Designate an on-site Transportation Coordinator to oversee move-in/move-out operations and serve as the point person for managing, communicating, and promoting the use of alternative transportation measures with building employees and staff; and develop transportation alternatives orientation materials for residents, visitors, and retail employees.
	Marketing: Develop and disseminate welcome packets to residents with tailored marketing information about nearby transportation options.
	Annual Events: Conduct an annual events promoting multimodal travel.
	Real-Time Transit Information: Provide real-time transit information displayed on-screen in the entry of building lobbies (Transit Screen).
	Emergency Ride Home: Provide (via the TMA) ride services, such as reimbursement of taxi or rideshare trips, outside of peak travel periods for tenants/employees who use sustainable transportation options.
Vehicle Impact	Provide no on-site parking
Transit Baseline	Participation in MBTA Perq Program to facilitate purchase of transit passes.
Bicycling Baseline	Comply with BTB Bike Parking Guidelines, including provision of up to 128 long term and 32 short-term bike parking on-site.
	Provide on-site “Fix-it” bicycle repair kit or station.
Development	Provide on-site library component
Elective	Provide a designated area for receiving deliveries such as package/mail, laundry, or groceries (cold storage).

#### **4.7 Transportation Mitigation Measures**

While the traffic impacts associated with the new trips are minimal, the Proponent will continue to work with the City of Boston to ensure that the Proposed Project efficiently serves vehicle trips, improves the pedestrian environment, and encourages transit and bicycle use. As part of the Proposed Project, the Proponent will bring all abutting sidewalks and pedestrian ramps to the City of Boston standards in accordance with the Boston Complete Streets design guidelines, while also accommodating the stepped entrance area to the new Library branch. This may include the reconstruction and widening of the sidewalks where feasible, the installation of new, accessible ramps, improvements to street lighting where necessary, planting of street trees, and providing

bicycle storage racks surrounding the Project Site, where appropriate. The Proponent understands that the City is in the process of updating bike infrastructure along Cambridge Street and will coordinate with city staff to ensure that any work associated with the Proposed Project will not preclude the city's layout changes where the curb line abutting the Project Site is assumed to remain in its current location.

#### **4.8 Transportation Access Plan Agreement**

The Proponent is responsible for preparation of the Transportation Access Plan Agreement (TAPA), a formal legal agreement between the Proponent and the BTB. The TAPA formalizes the findings of the transportation study, mitigation commitments, elements of access and physical design, travel demand management measures, and any other responsibilities that are agreed to by both the Proponent and the BTB. Because the TAPA must incorporate the results of the technical analysis, it must be executed after these other processes have been completed. The proposed measures listed above and any additional transportation improvements to be undertaken as part of the Proposed Project will be defined and documented in the TAPA.

#### **4.9 Short-Term Construction Impacts**

Most construction activities will be accommodated within the current boundaries of the Project Site. Details of the overall construction schedule, working hours, number of construction workers, worker transportation and parking, number of construction vehicles, and routes will be addressed in detail in a Construction Management Plan to be filed with BTB in accordance with the City's transportation maintenance plan requirements. The Construction Management Plan will document all committed measures and will be executed with the City prior to commencement of construction. To minimize transportation impacts during the construction period, the following measures will be considered for the Construction Management Plan:

- Limited construction worker parking on site;
- Encouragement of worker carpooling; and
- Providing secure spaces on-site for workers' supplies and tools so they do not have to be brought to the site each day.



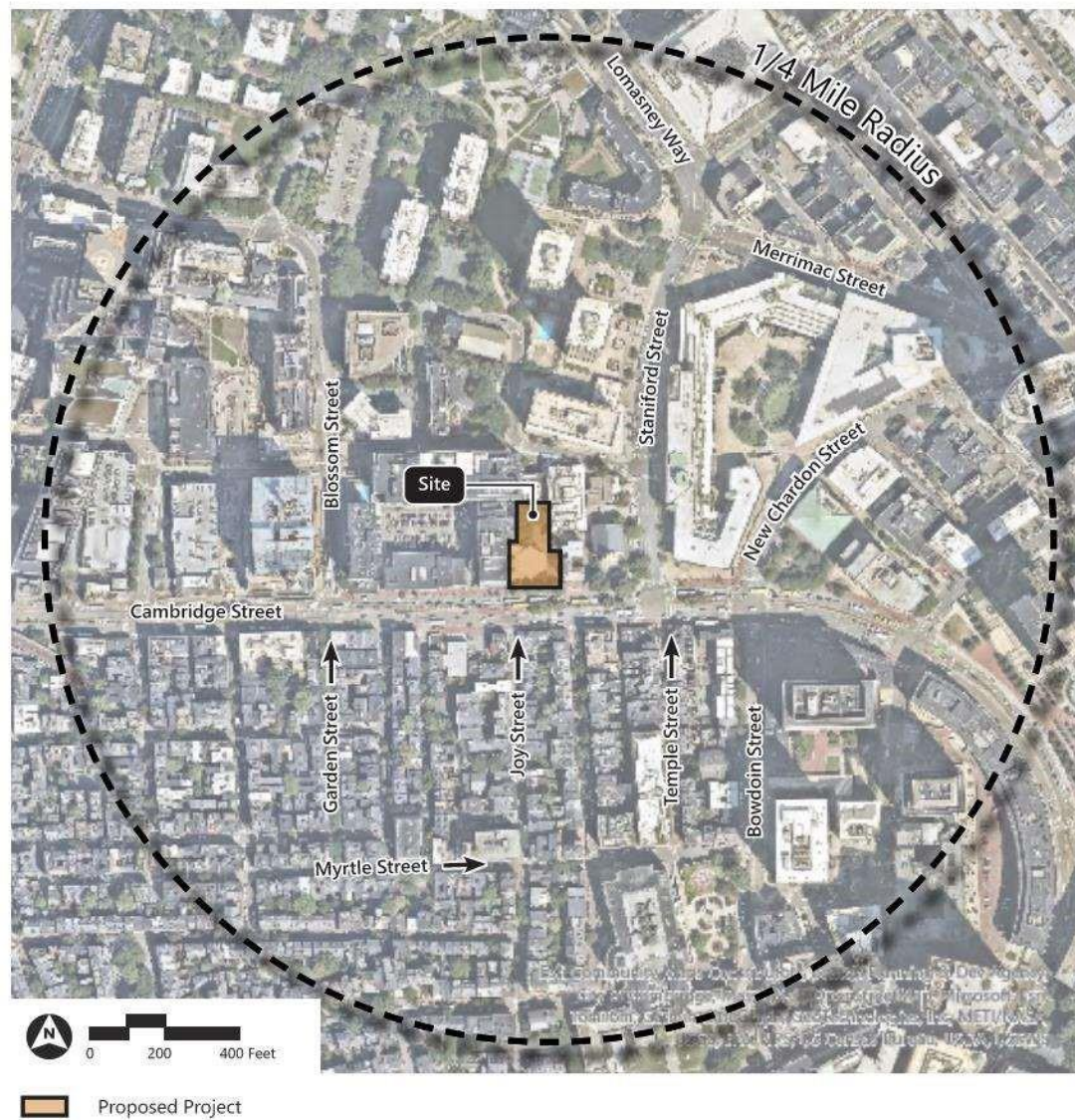
**Figure 4-1 Site Context**

**Figure 4-1: Site Context**

151 Cambridge Street | Boston, MA



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Source: Nearmap Aerial, Accessed Aug. 23, 2024

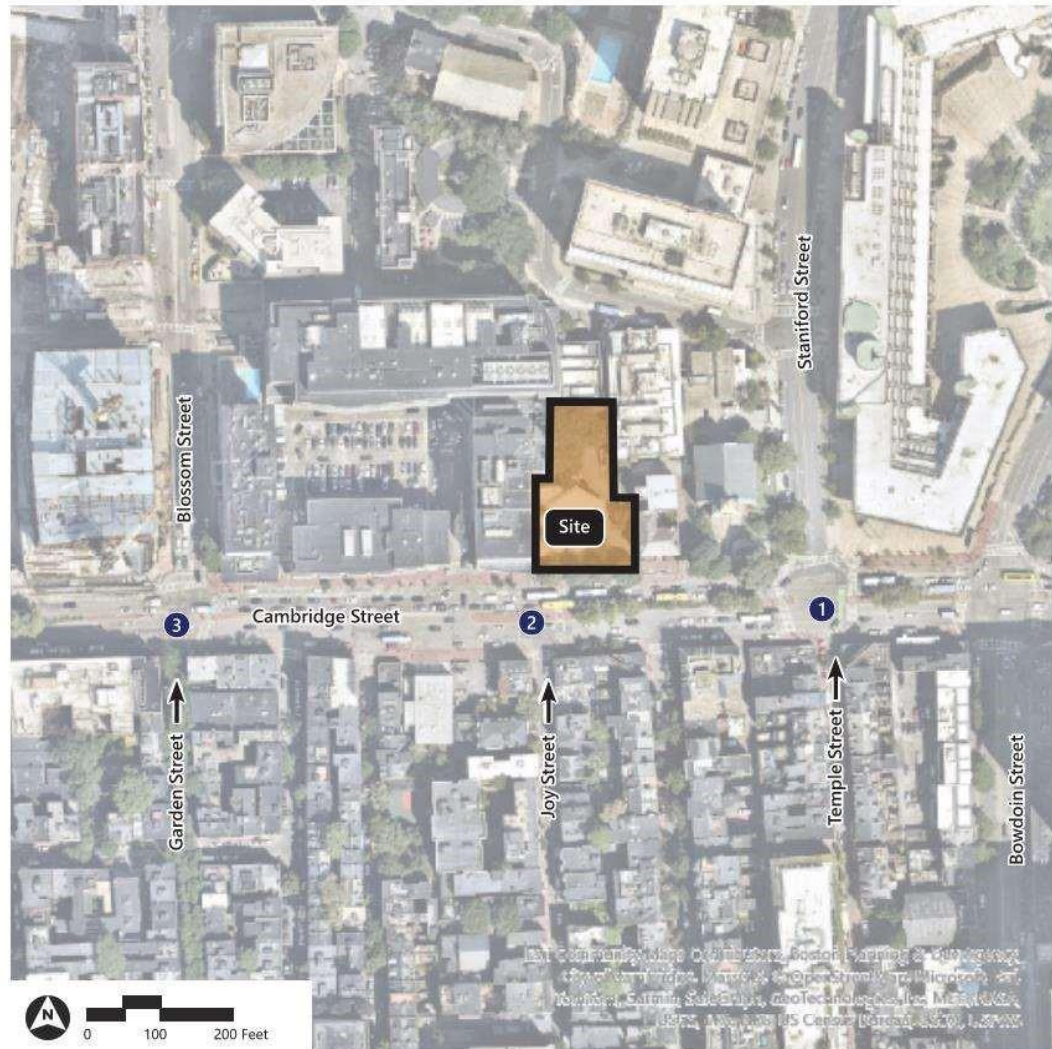
**Figure 4-2 Study Area Intersections**

**Figure 4-2: Study Area Intersections**

151 Cambridge Street | Boston, MA



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Proposed Project

**Intersections**

- 1** Cambridge Street at Staniford Street/Temple Street
- 2** Cambridge Street at Joy Street
- 3** Cambridge Street at Blossom Street/Garden Street

*Nearmap Aerial, Accessed Aug. 23, 2024*



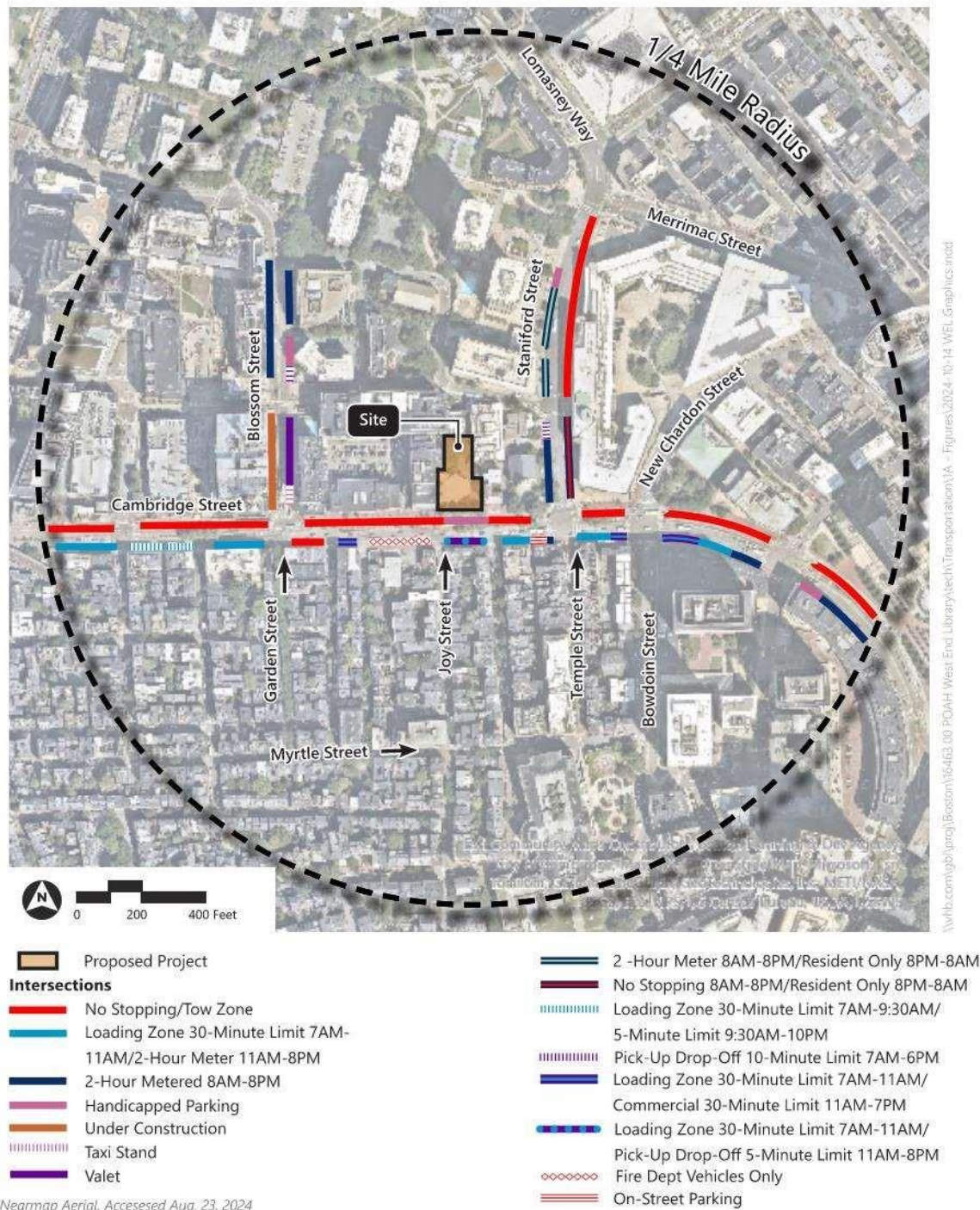
**Figure 4-3 Roadway Curb Use Regulations**

**Figure 4-3: Roadway Curb Use Regulations**

151 Cambridge Street | Boston, MA



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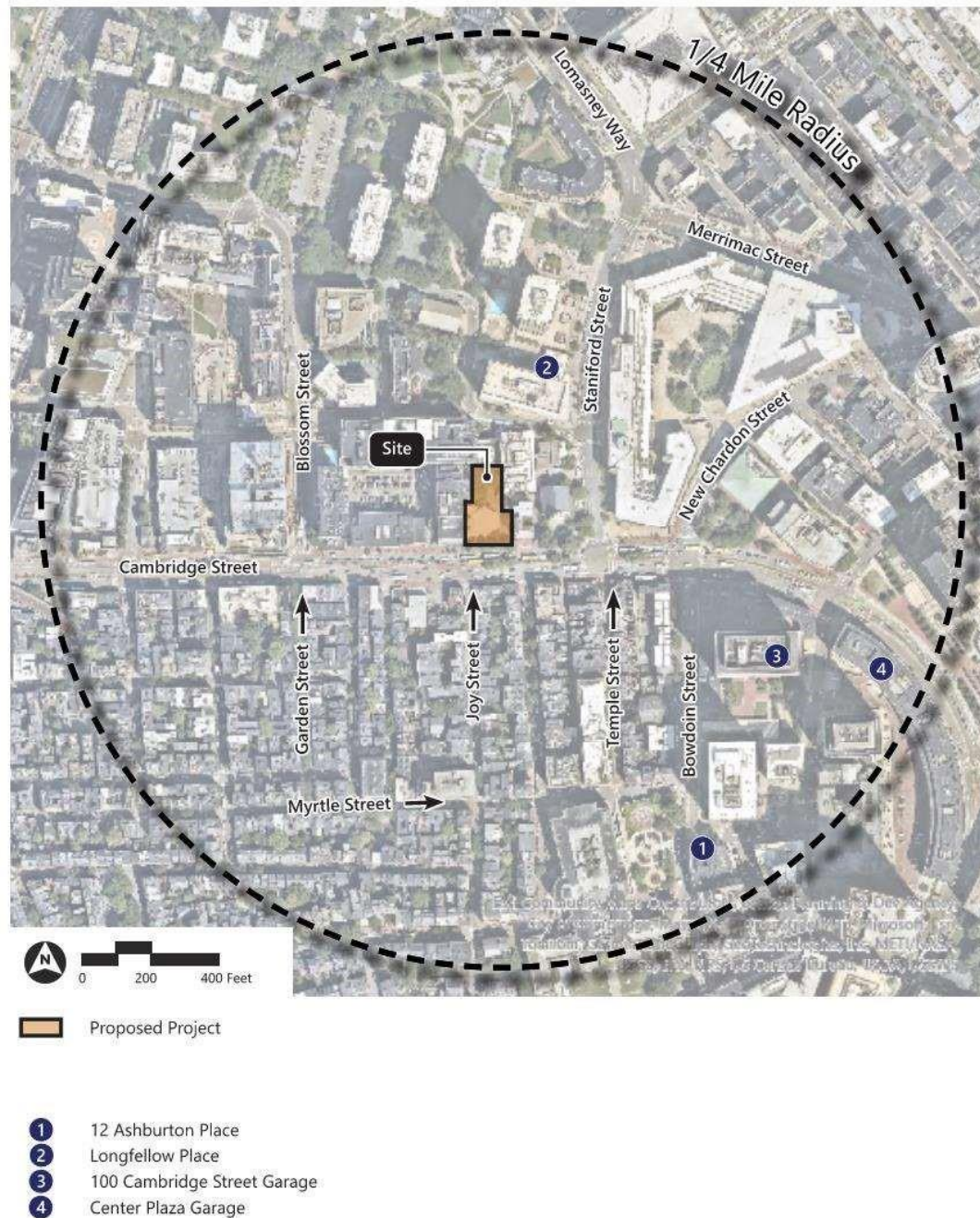
**Figure 4-4 Publicly Available Garages**

**Figure 4-4: Publicly Available Garages**

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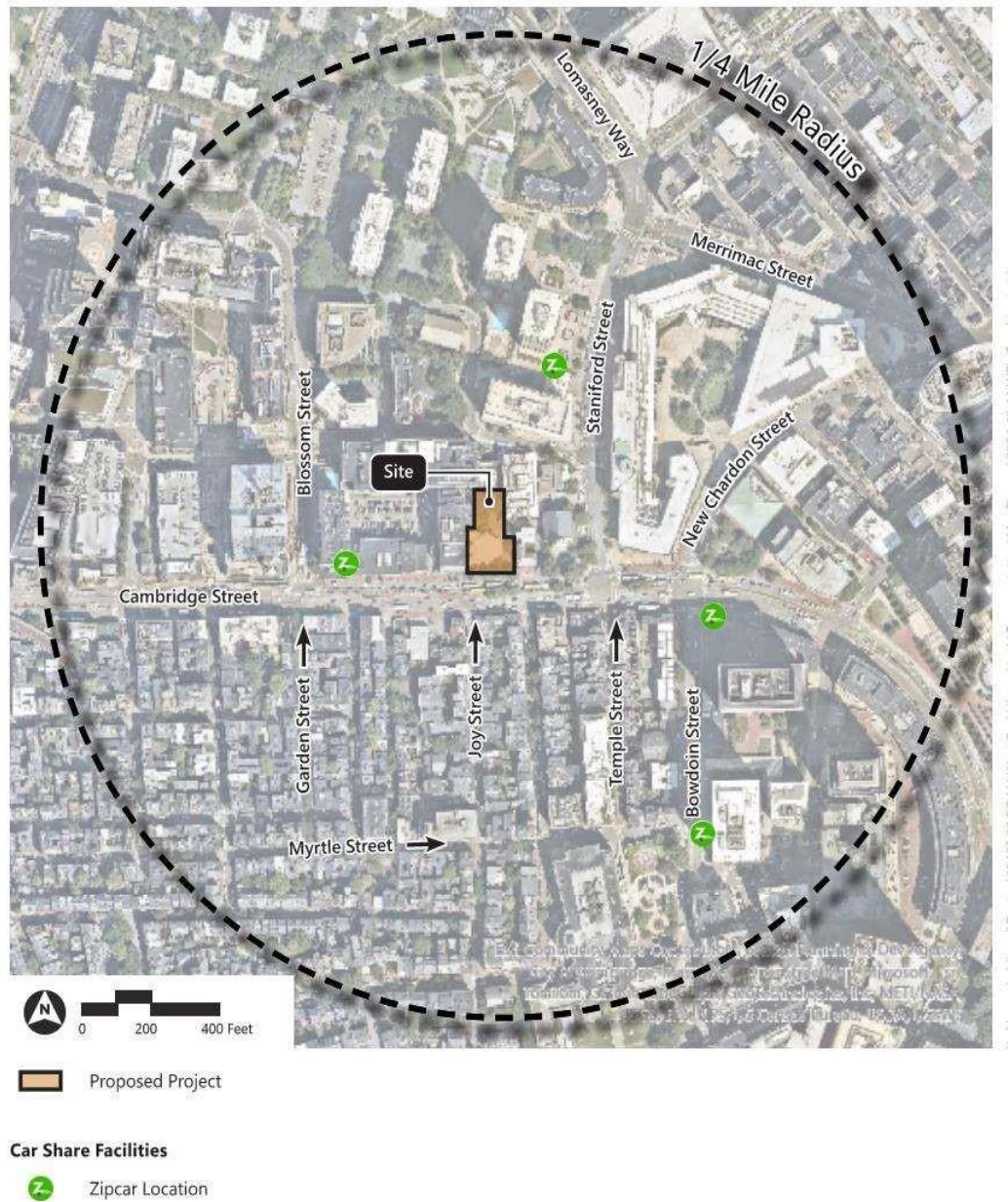
**Figure 4-5 Car Share Network**

**Figure 4-5: Car Share Network**

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Source: Nearmap Aerial, Accessed Aug. 23, 2024; Zipcar Map System Website, Accessed Oct. 18, 2024

**Figure 4-6 2024 Baseline Conditions Vehicle Volumes – AM Peak Hour**

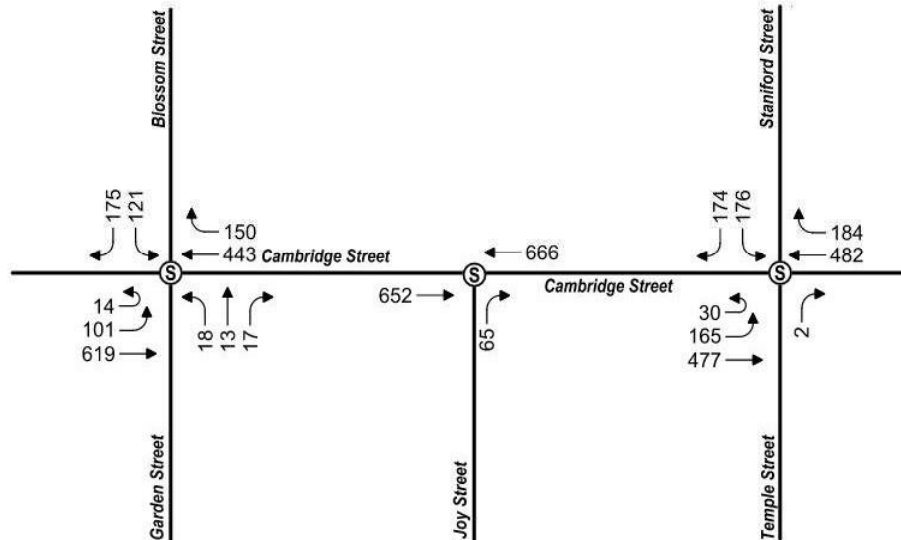
**Figure 4-6: 2024 Baseline Conditions Vehicle Volumes - AM Peak Hour**

151 Cambridge Street | Boston, MA



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Ⓢ Signalized Intersection



Not to Scale

Counts conducted on August 15, 2018, provided by the Boston Transportation Department, no annual growth rate was applied to the historic volumes per BTD guidelines. Peak hour volumes are based on individual intersection peak hour.

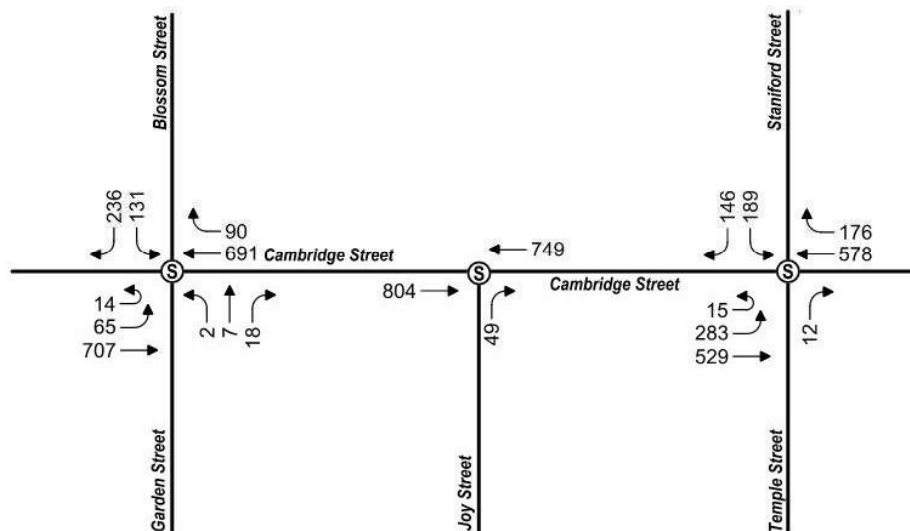
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**Figure 4-7 2024 Baseline Conditions Vehicle Volumes – PM Peak Hour**

**Figure 4-7: 2024 Baseline Conditions Vehicle Volumes - PM Peak Hour**  
151 Cambridge Street | Boston, MA

**vhb**  
12/16/2024

Ⓢ Signalized Intersection



Ⓢ Not to Scale

Counts conducted on August 15, 2018, provided by the Boston Transportation Department, no annual growth rate was applied to the historic volumes per BTD guidelines. Peak hour volumes are based on individual intersection peak hour.

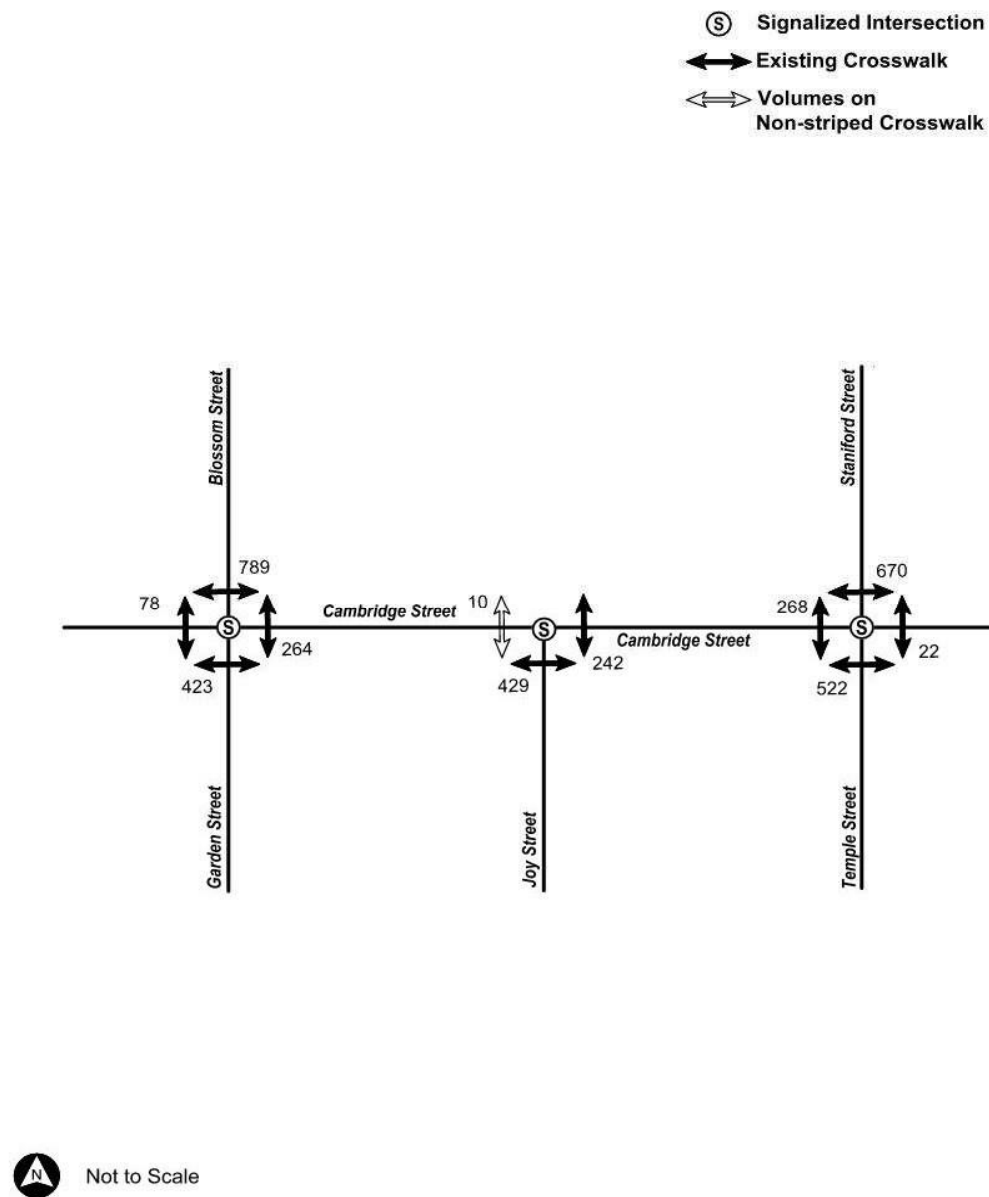
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**Figure 4-8 2024 Baseline Conditions Pedestrian Volumes – AM Peak Hour**

**Figure 4-8: 2024 Baseline Conditions Pedestrian Volumes - AM Peak Hour**

151 Cambridge Street | Boston, MA

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12/16/2024



Counts conducted on August 15, 2018, provided by the Boston Transportation Department, no annual growth rate was applied to the historic volumes per BTM guidelines. Peak hour volumes are based on individual intersection peak hour.



**Figure 4-9 2024 Baseline Conditions Pedestrian Volumes – PM Peak Hour**

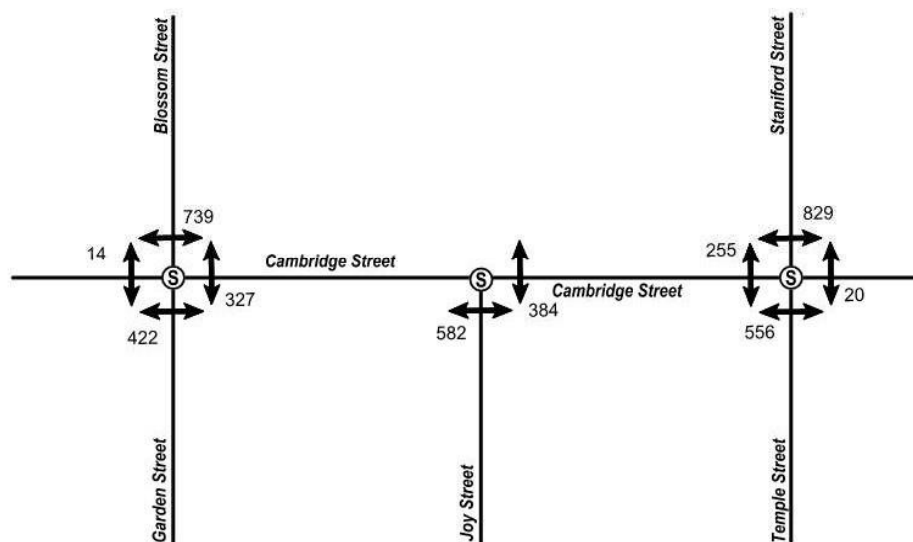
**Figure 4-9: 2024 Baseline Conditions Pedestrian Volumes - PM Peak Hour**

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- Ⓢ Signalized Intersection
- ↔ Existing Crosswalk
- ↔ Volumes on Non-striped Crosswalk



Not to Scale

Counts conducted on August 15, 2018, provided by the Boston Transportation Department, no annual growth rate was applied to the historic volumes per BTS guidelines. Peak hour volumes are based on individual intersection peak hour.

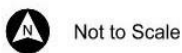
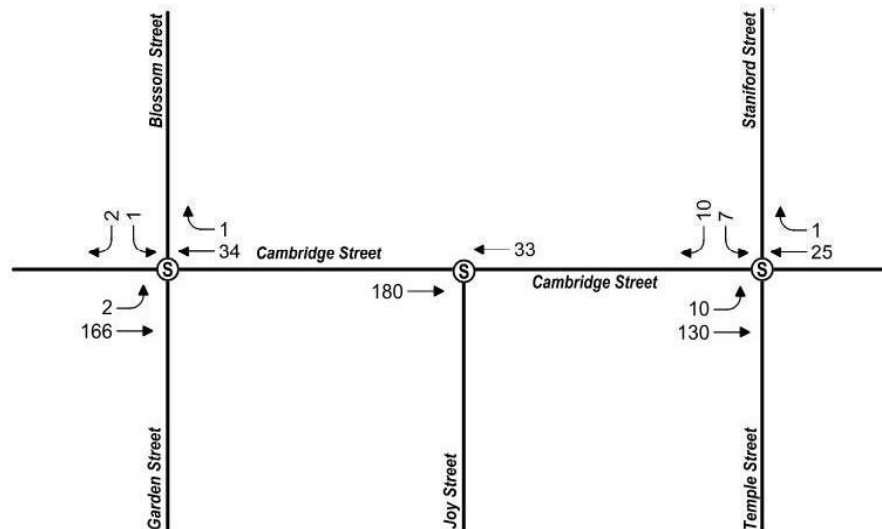
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**Figure 4-10 2024 Baseline Conditions Bicycle Volumes – AM Peak Hour**

**Figure 4-10: 2024 Baseline Conditions Bicyclists Volumes - AM Peak Hour**  
151 Cambridge Street | Boston, MA



Ⓢ Signalized Intersection  
neg = Negligible



Counts conducted on August 15, 2018, provided by the Boston Transportation Department, no annual growth rate was applied to the historic volumes per BTS guidelines. Peak hour volumes are based on individual intersection peak hour.

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**Figure 4-11 2024 Baseline Conditions Bicycle Volumes – PM Peak Hour**

**Figure 4-11: 2024 Baseline Conditions Bicyclists Volumes - PM Peak Hour**

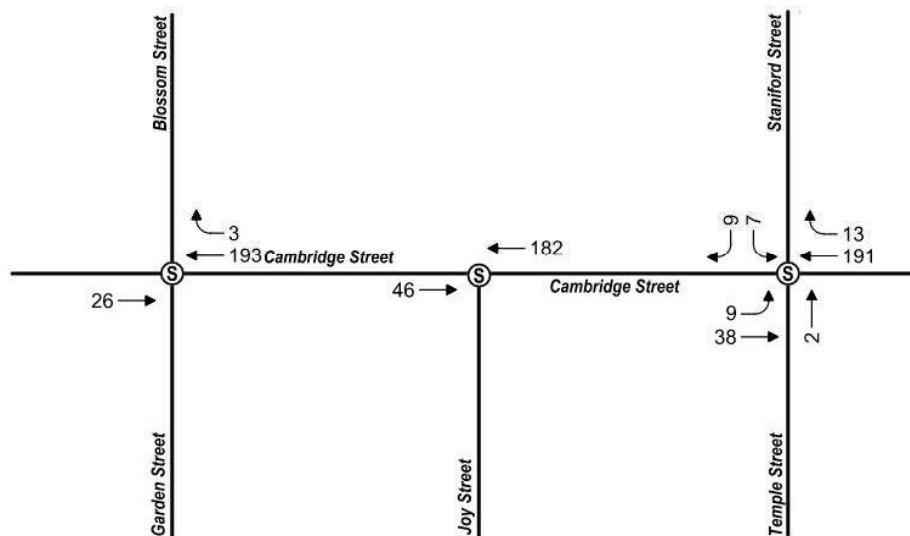
151 Cambridge Street | Boston, MA



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Ⓢ Signalized Intersection

neg = Negligible



Not to Scale

Counts conducted on August 15, 2018, provided by the Boston Transportation Department, no annual growth rate was applied to the historic volumes per BTM guidelines. Peak hour volumes are based on individual intersection peak hour.

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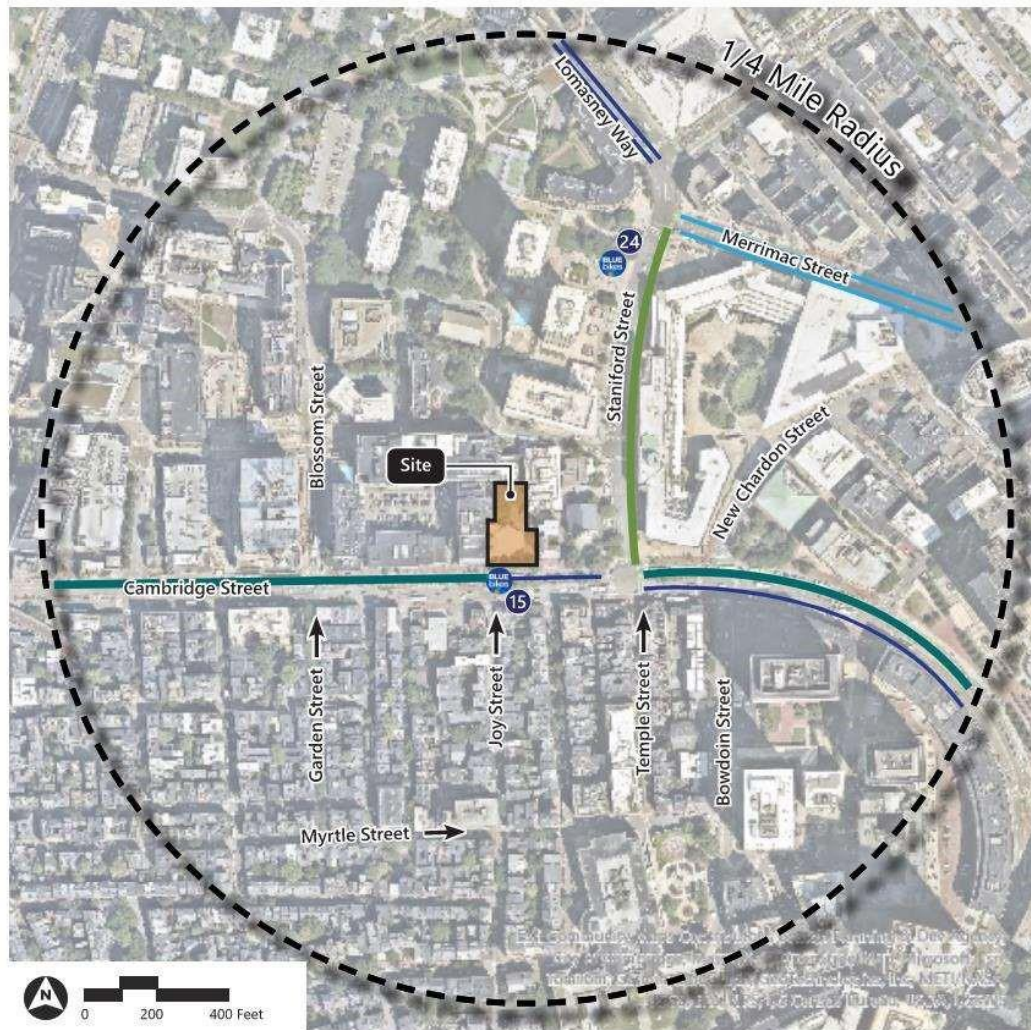
**Figure 4-12 Bicycle Infrastructure and Bluebike Station Locations**

**Figure 4-12: Bicycle Infrastructure and BlueBike Station Locations**

151 Cambridge Street | Boston, MA



12/16/2024



Proposed Project

**Bike Facilities**

- Bluebikes Station
- Separated Bike Lane, On-Street
- Bike Lane, On-Street
- Shared Lane, On-Street
- Separated Bike Lane, Off-Street

Number of Bike Docks

Source: Nearmap Aerial, Accessed Aug. 23, 2024; Bluebike Station System Map Website, Accessed Oct. 18, 2024.



**Figure 4-13 Transit Opportunities**

**Figure 4-13: Transit Opportunities**

151 Cambridge Street | Boston, MA










**DRAFT** 10/2024



## 5. Sustainable Design

### 5.1 Introduction

The Proponent is committed to implementing measures aimed at reducing energy and water consumption, enhancing the efficiency and longevity of building systems and infrastructure, and lessening the impact of buildings on city services, the environment, and public health. In line with these goals, the Proposed Project will use the Leadership in Energy and Environmental Design (LEED) v4 for BD+C New Construction to track its approach to sustainability and to show compliance with the City's Green Building Initiative program and Article 37 of the Code. The Proposed Project is targeting 62 points and a LEED summary is provided below to outline the specific credits being pursued for this project, with further highlights detailed in subsequent sections.

LEED Category		Targeted Points	Maybe Points
	Integrative Process	1	
	Location and Transportation	13	
	Sustainable Sites	6	1
	Water Efficiency	4	1
	Energy and Atmosphere	18	2
	Materials and Resources	5	4
	Indoor Environmental Quality	7	4
	Innovation and Regional Priority	8	1
<b>Total</b>		<b>62</b>	<b>13</b>

## **5.2 Integrative Process**

The project team includes several LEED Accredited Professionals who will lead the sustainability efforts and initiatives throughout the design and construction process. Sustainable design and energy efficiency goals were established early, and strategies associated with the building envelope attributes (i.e., lighting design, thermal comfort ranges, plug and process loads, and operational parameters) and their impact on the building energy performance will be explored and discussed throughout the design process. An early design WUFI Passive energy model was developed and used as an interactive and dynamic platform to evaluate systems synergies and the various pathways for achieving the targeted energy use intensity (EUI) and carbon emissions intensity (CEI) and required performance improvements in the most cost-effective manner.

## **5.3 Location and Transportation**

The Proposed Project will be a new construction project on a previously developed site and its location allows site users to take advantage of nearby amenities, services and transportation options. The Project Site is in an area with a Walk Score of 98, Transit Score of 100, and Bike Score of 78 and is within a one-half mile walking distance of at least eight basic services.

The Project Site is proximate to public transit and the building users will have access to several nearby MBTA stations, including Charles/MGH (Red Line) and Government Center (Green and Blue Lines), which gives them the opportunity to travel through the Boston metro area.

The Proposed Project will not provide any vehicle parking spaces and therefore meets the LEED Parking Capacity requirements.

## **5.4 Sustainable Site**

The Proposed Project will use LEED v4 and v4.1 Guidelines as a baseline for implementing strategies to eliminate the negative environmental impacts associated with new construction. A management plan will enforce Erosion and Sedimentation measures to protect adjacent areas from pollution from wind and water-borne soil and sedimentation. The project team will conduct a comprehensive site assessment and will study topography, hydrology, climate, vegetation, soils, human use, and human health effects specific to the Proposed Project. The roof is anticipated to be light-color TPO which will help with reducing the Heat Island Effect.

The Proposed Project will implement effective stormwater management techniques, such as green infrastructure, permeable pavement, and retention and detention basins to reduce runoff, control erosion, and prevent water pollution. Infiltration systems are anticipated to further promote stormwater infiltration to the extent feasible. The Proposed Project is anticipated to be treating a volume equivalent to 1.25 inch of rainfall on the site impervious area.

## **5.5 Water Efficiency**

Buildings are major users of potable water supplies and conservation of water preserves a natural resource while reducing the amount of energy and chemicals used for sewage treatment. The goal of the Water Efficiency LEED credit category is to encourage smarter use of water, both inside and outside.

The Proposed Project is anticipated to reduce the use of potable water inside the new building by at least 35% from the LEED baseline by installing low-flow and low-flush plumbing fixtures. Water efficient appliances, including Energy Star Certified clothes washers and dishwashers, will also be installed. Regularly monitoring and promptly addressing leaks in plumbing systems and fixtures is essential to prevent water waste and, accordingly, a leak detection system will be implemented, and regular inspections will be conducted to help identify and resolve leaks quickly to minimize water loss. Water conservation awareness will be promoted among residents, and they will be encouraged to be mindful of water consumption.

The landscaping around the proposed new building will be mostly native and adopted plants, and the project team will seek to reduce outdoor potable water use by at least a 50% reduction from the LEED baseline.

## **5.6 Energy and Atmosphere**

In alignment with the City of Boston carbon neutrality goals and Opt-In Specialized Energy Code, the building will be designed and constructed with high-performance envelope and MEP systems to reduce space heating and cooling demands. The Proposed Project will be designed to meet the Passive House (PHIUS) standard requirements. A WUFI Passive model was developed to evaluate pathways for achieving the targeted heating and cooling loads and Source Energy. Using WUFI modeling software, the project team identified the envelope thermal properties necessary to meet PHIUS standards. Achieving Passive House certification ensures compliance



with LEED Interpretation 10486 for LEED v4, resulting in a 30% improvement in energy performance compared to ASHRAE 90.1-2010, which equates to 12 LEED points. More details on the energy modeling report are included in [Appendix D](#) of this PNF.

Energy conservation measures are anticipated to include a high-performance building envelope system, reduced lighting power density, high-efficiency all-electric HVAC system, and low-flow hot water fixtures to reduce hot water demand.

The mechanical system for the Proposed Project will be designed to meet and exceed the IECC 2021 efficiency requirements. The equipment installed will be high-performance, energy-efficient, and will not include any CFC (chlorofluorocarbon) refrigerants that deplete the ozone layer. The MEP systems will be commissioned by a third-party commissioning agent to ensure correct installation and operation. Commissioning activities include verification of system and equipment installation in accordance with the construction documents and manufacturer's instructions, and confirmation that equipment start, test, and check also meet manufacturer's requirements.

## **5.7 Materials and Resources**

The Proposed Project will pursue the LEED v4.1, Building Product Disclosure and Optimization credits with a focus on selecting materials that are responsibly sourced, have recycled content and a low-carbon footprint, and promote material transparency through EPDs, HPDs, and Cradle to Cradle certification programs.

The materials selected for the Proposed Project will be evaluated using a variety of criteria including a preference for materials extracted, processed and manufactured locally. This reduces the energy consumption and emissions associated with transportation and helps local economies.

The project team, including the construction manager and their sub-contractors, will target the specification and use of at least 20 different permanently installed products and materials that have lower environmental impacts, and comply with Environmental Product Declaration ("EPD"), conforming to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930. The project team is also targeting the Material Ingredients LEED credit and will specify materials and products with known chemical make-up. Documentation for at least 20 different permanently installed

products will be provided, confirming the applicable certification which may be the Health Product Declaration (“HPD”), Cradle-to-Cradle or Declare. In the design of the Proposed Project, careful consideration will be given to selecting sustainable and health-conscious materials, fostering a community that prioritizes both ecological responsibility and occupants’ wellbeing. Through comprehensive research and Life Cycle Assessment, the project team will explore opportunities for reducing the embodied carbon associated with the Proposed Project.

A central area for sorting and collection of recyclables before removal from the Project Site will be provided. Recyclable materials collected are expected to include mixed paper, corrugated cardboard, glass, plastics, and metals, and the disposal of batteries and electronic waste. The waste generated by the construction and demolition process is proposed to be recycled to the extent feasible, rather than land-filled, and the ultimate goal is for more than 50% (by weight) of the construction waste, including five waste streams, to be recycled.

## **5.8 Indoor Environmental Quality**

Healthy indoor environments have a vital role in improving the health and wellbeing of occupants by reducing respiratory issues associated with poor ventilation and presence of allergens and pollutants, by preventing Sick Building Syndrome, by minimizing chemical exposure, especially VOCs, and by improving sleep quality. In alignment with the Proposed Project’s health and wellbeing goals, the project team will employ strategies to identify and eliminate potential sources of indoor air pollutants, to provide adequate ventilation, and to maintain a healthy indoor environment. The mechanical systems will be designed to comply with the ASHRAE 55, the indoor temperature, and humidity conditions standard, and to provide superior ventilation throughout the building, following the requirements of ASHRAE 62.1-2019 sections 4 through 7.

The building will have a no-smoking policy and smoking will be prohibited outside on the Project Site within 25 feet of doors, operable windows and outside air intakes. The building will be constructed in accordance with the Sheet Metal and Air Conditioning Contractors’ National Association (“SMACNA”) Indoor Air Quality for Buildings under Construction Guideline. This guideline defines procedures for maintaining good indoor air quality inside the building during construction and addresses construction practices to allow the best possible indoor environment after occupancy. These practices include cleaning during construction,

interrupting paths of odor and dust travel within the building, segregating odor and dust producing activities from absorbent materials, and scheduling similar odor or dust producing activities to occur at the same time.

Adhesives, sealants, and paints used inside the building will be selected to be low Volatile Organic Compound (“VOC”) products, and specified wood products will have no added urea-formaldehyde. All spaces where hazardous gases or chemicals may be present or used, i.e., housekeeping closets, will be designed with full height walls, exhaust ventilation and a door closer. Building entrances will be provided with walk-off mats to remove dirt and debris from the shoes of people entering the building and will be cleaned and maintained by house-keeping weekly while the space is vacant. High-efficiency MERV 13 filters will be provided in the main outside air handling unit for superior air particulate filtration.

## **5.9 Innovation and Design LEED Strategy**

The project team will evaluate and implement measures and strategies in the design and construction of the Proposed Project to exceed the performance criteria of some of the base credits and may introduce innovative building features, technologies, and policies that are not addressed by existing prerequisites and credits in the BD+C rating system. The innovative strategies may include development and implementation of an Operation and Maintenance (“O+M”) Starter Kit, including Green Cleaning policies, Housing Type and Affordability, Green Building Education, Exemplary Performance credits, and Purchasing Lamps policy.

## **5.10 Regional Priority**

Regional Priority LEED credits were established with a focus on environmental issues and priorities at a local level. There are six possibilities specific to the Project Site and the project team has targeted the following strategies: (a) At least an 18% savings in Optimize Energy Performance and (b) Rainwater Management.

Figure 5-1 LEED Project Checklist



**LEED v4 for BD+C: New Construction and Major Renovation**  
Project Checklist

Project Name: West End Library  
Date: 11/15/2024

Y	?	+	?	-	N		
1						Credit	Integrative Process 1
13	0	0	3				<b>Location and Transportation 16</b>
						Credit	LEED for Neighborhood Development Location 16
1						Credit	Sensitive Land Protection 1
1			1			Credit	High Priority Site 2
5						Credit	Surrounding Density and Diverse Uses (LEED v4.1) 5
5						Credit	Access to Quality Transit (LEED v4.1) 5
			1			Credit	Bicycle Facilities (LEED v4.1) 1
1						Credit	Reduced Parking Footprint 1
			1			Credit	Electric Vehicles (LEED v4.1) 1
6	0	1	3				<b>Sustainable Sites 10</b>
Y						Prereq	Construction Activity Pollution Prevention Required
1						Credit	Site Assessment 1
			2			Credit	Site Development - Protect or Restore Habitat (LEED v4.1 - Campus) 2
			1			Credit	Open Space (LEED v4.1) 1
3						Credit	Rainwater Management (LEED v4.1) 3
2						Credit	Heat Island Reduction 2
			1			Credit	Light Pollution Reduction 1
4	1	0	6				<b>Water Efficiency 11</b>
Y						Prereq	Outdoor Water Use Reduction (Campus) Required
Y						Prereq	Indoor Water Use Reduction Required
Y						Prereq	Building-Level Water Metering Required
1	1					Credit	Outdoor Water Use Reduction (Campus) 2
3						Credit	Indoor Water Use Reduction 6
			2			Credit	Cooling Tower Water Use 2
			1			Credit	Water Metering 1
18	0	2	13				<b>Energy and Atmosphere 33</b>
Y						Prereq	Fundamental Commissioning and Verification Required
Y						Prereq	Minimum Energy Performance Required
Y						Prereq	Building-Level Energy Metering Required
Y						Prereq	Fundamental Refrigerant Management Required
5				1		Credit	Enhanced Commissioning 6
12				6		Credit	Optimize Energy Performance 18
			1			Credit	Advanced Energy Metering 1
			2			Credit	Demand Response 2
			1	2		Credit	Renewable Energy Production 3
1						Credit	Enhanced Refrigerant Management 1
						Credit	Green Power and Carbon Offsets 2

Y	?	+	?	-	N		
5	2	2	4				<b>Materials and Resources 13</b>
Y						Prereq	Storage and Collection of Recyclables Required
Y						Prereq	Construction and Demolition Waste Management Planning Required
1	1	1	2			Credit	Building Life-Cycle Impact Reduction (LEED v4.1) 5
1	1					Credit	Environmental Product Declarations 2
			1	1		Credit	Sourcing of Raw Materials (LEED v4.1) 2
2						Credit	Material Ingredients (LEED v4.1) 2
1				1		Credit	Construction and Demolition Waste Management 2
7	0	4	5				<b>Indoor Environmental Quality 16</b>
Y						Prereq	Minimum Indoor Air Quality Performance Required
Y						Prereq	Environmental Tobacco Smoke Control Required
1			1			Credit	Enhanced Indoor Air Quality Strategies 2
3						Credit	Low-Emitting Materials 3
1						Credit	Construction Indoor Air Quality Management Plan 1
				2		Credit	Indoor Air Quality Assessment 2
1						Credit	Thermal Comfort 1
				2		Credit	Interior Lighting (LEED v4.1) 2
			3			Credit	Daylight 3
1						Credit	Quality Views 1
				1		Credit	Acoustic Performance 1
6	0	0	0				<b>Innovation 6</b>
1						Credit	Innovation: Green Building Education or Exemplary Performance 5
1						Credit	Innovation: Housing Type and Affordability
1						Credit	Exemplary Performance: EPDs
1						Credit	Innovation: LEED O+M Starter Kit or Integrative Materials Analysis
1						Credit	Innovation: Purchasing - Lamps
1						Credit	LEED Accredited Professional 1
2	1	0	1				<b>Regional Priority 4</b>
1				1		Credit	Regional Priority: High Priority Site (2) 1
1						Credit	Regional Priority: Indoor Water Use Reduction (4) Rainwater Management (2) 1
						Credit	Regional Priority: Optimize Energy Performance (8)/Renewable Energy (1) 1
	1					Credit	Regional Priority: Building LCA (2) 1
62	4	9	35				<b>TOTALS Possible Points: 110</b>

Certified: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80 to 110



## **6. Environmental Review Component**

### **6.1 Wind Analysis**

#### **6.1.1 Introduction**

The full Wind Analysis Report is provided in [Appendix F](#) of this PNF. An executive summary is provided below.

#### **6.1.2 Executive Summary**

##### **6.1.2.1 Project Description**

RWDI was retained to conduct a Pedestrian Wind Assessment for the proposed West End Library project in Boston, Massachusetts, (See Image 1 of the full report). The Proposed Project is located on the north side of Cambridge Street between Blossom Street and Staniford Street in the City of Boston. The Proposed Project will be approximately 165 feet tall, consisting of a BPL branch library on the first two stories and approximately 119 residential units within 12 additional stories.

##### **6.1.2.2 Objectives**

The objective of the study was to assess the effect of the Proposed Project on local conditions in pedestrian areas on and around the study site, and provide recommendations for minimizing adverse effects, if needed. This quantitative assessment was based on wind speed measurements on a scale model of the Proposed Project and its surroundings in one of RWDI's boundary-layer wind tunnels. These measurements were combined with the local wind records and compared to appropriate criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian areas, including building entrances, public sidewalks and walkways, and outdoor amenity areas.

##### **6.1.3 Results of Analysis**

The potential wind conditions have been assessed based on the Wind Tunnel Testing of the Proposed Project under the No Build and Build Configurations (Images 2A and 2B of the full report), and the local wind records (Image 3 of the full report) compared to the Mean Speed and Effective Gust criteria adopted by the Planning Department. The results of the assessment are shown on site plans in Figures 1A through 2C of the full report, and the associated wind speeds are listed in Tables 1 and 2 of the full report. The key findings are summarized as follows:

### **Effective Gust**

- The effective gust criterion will not be exceeded on an annual and seasonal basis in both the No Build and Build Configurations.

### **Mean Speed**

- No dangerous mean speeds are predicted for either of the configurations assessed on an annual and seasonal basis.
- Existing wind conditions in the No Build Configuration are comfortable for the intended pedestrian usage on and around the Project Site on an annual basis.
- In the Build Configuration, wind conditions at most locations are expected to be similar to those in the No Build Configuration, with slightly elevated wind conditions that remain comfortable for pedestrian use around the southeast corner of the Proposed Project during the summer.

## **6.2 Shadow Analysis**

### **6.2.1 Introduction**

This section discusses the shadow analysis conducted for the Proposed Project. As described below, existing buildings already cast significant shadow on the area surrounding the Project Site, and net new shadow resulting from the Proposed Project will be limited in extent and duration.

### **6.2.2 Methodology and Results**

This study presents conditions for the Proposed Project for the hours of 9:00 AM, 12:00 noon and 3:00 PM for March 21st (vernal equinox), June 21st (summer solstice), September 21st (autumnal equinox), and December 21st (winter solstice). Diagrams prepared for this analysis are provided on [Figures 1-36](#) through [1-47](#) (see [Section 3, Urban Design](#)). Existing shadows cast are shown in **grey** on these figures, and net new shadows created by the Proposed Project are shown in **purple**.

The diagrams illustrate that in the mornings across all dates of the study, the Proposed Project casts new shadow towards the northwest and onto abutting commercial and institutional buildings.

At noon, shadows are cast to the north onto an abutting institutional building. At the equinoxes these shadows extend out into William Cardinal O'Connell Way. At the winter

solstice, the net new shadow joins existing shadows in reaching onto the existing building at the northern side of William Cardinal O'Connell Way.

The afternoon shadow at 3 PM on the equinoxes extends to the northeast over mid-rise institutional buildings and onto Staniford Street. The existing shadow extends onto Staniford Street with the net new shadow increasing the extent of this impact. At winter solstice, existing shadows extend deep towards the northwest enveloping the majority of William Cardinal O'Connell Way and Staniford Street with the modest amount of net new shadow infilling select areas.

### **6.2.3 Conclusion**

This analysis illustrates that the existing buildings in the area already cast a considerable shadow, with the largest impacts in the afternoon towards the north and northeast. Net new shadows created by this project are in keeping with this existing pattern with the most impact on existing buildings. While the project does create pockets of new shadow on Staniford Street and O'Connell Way, these shadows are in keeping with existing shadows already at those streetscapes. Our design strategies to setback the bulk of the massing and split the building form help mitigate and minimize the shadow impacts to Cambridge Street, and the historic Otis House and Old West Church.

## **6.3 Daylight Analysis**

### **6.3.1 Introduction**

This section discusses the daylight analysis completed for the Proposed Project, which estimates the extent to which a project affects the amount of daylight reaching public areas around a project, and the limited impacts that the Proposed Project will have on the surrounding area. Results of the Boston Redevelopment Authority Daylight Analysis ("BRADA") indicated that while development of the Proposed Project will result in increased daylight obstruction over existing conditions, the resulting conditions will be less than the daylight obstruction values within the surrounding area.

### 6.3.2 Methodology

The daylight analysis was performed using the BRADA computer program<sup>3</sup>. This program measures the percentage of “sky dome” that is obstructed by a project and is a useful tool in evaluating the net change in obstruction from existing to build conditions at a specific site.

Using BRADA, a silhouette view of the building is taken at ground level from the middle of the adjacent city streets or pedestrian ways centered on the proposed building. The façade of the building facing the viewpoint, including heights, setbacks, corners and other features, is plotted onto a base map using lateral and elevation angles. The two-dimensional base map generated by BRADA represents a figure of the building in the "sky dome" from the viewpoint chosen. The BRADA program calculates the percentage of daylight that will be obstructed on a scale of 0 to 100 percent based on the width of the view, the distance between the viewpoint and the building, and the massing and setbacks incorporated into the design of the building. The lower the number, the lower the percentage of obstruction of daylight from any given viewpoint.

The analysis compares three conditions for the Project Site: (1) Existing Condition; (2) Proposed Condition; and (3) The context of the area.

- Two area context points were considered to provide a basis of comparison to existing conditions in the surrounding area. The viewpoints were taken from the following locations and are shown in [Figure 6-1](#) at the end of this section:
- **Viewpoint 1:** View from the center of Cambridge Street facing north toward the Project Site.
- **Area Context Viewpoint 1 (AC1):** View from the center of Cambridge Street facing south toward 218 Cambridge Street.
- **Area Context Viewpoint 2 (AC2):** View from the center of Cambridge Street facing south toward 100 Cambridge Street.

### 6.3.3 Results

Results for each viewpoint under each condition are described in [Table 6-1](#). [Figure 6-2](#) and [Figure 6-3](#) illustrate the BRADA results for each analysis.

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<sup>3</sup> Method developed by Harvey Bryan and Susan Stuebing, computer program developed by Ronald Fergle, Massachusetts Institute of Technology, Cambridge, MA, September 1984.



**Table 6-1 Daylight Obstruction Values**

Viewpoint Locations		Existing Conditions	Proposed Conditions
Viewpoint 1	View from the center of Cambridge Street facing north toward the Project Site	11.3%	44.6%
Area Context Points			
AC1	View from the center of Cambridge Street facing south toward 218 Cambridge Street	68.9%	N/A
AC2	View from the center of Cambridge Street facing south toward 100 Cambridge Street	72.9%	N/A

#### **6.3.4 Cambridge Street – Viewpoint 1**

Cambridge Street runs along the southern edge of the Project Site. Viewpoint 1 was taken from the center of Cambridge Street facing north toward the Project Site. Since the Project Site currently includes a low-rise building, the development of the Proposed Project is anticipated to result in a daylight obstruction value of 44.6 percent. While this is an increase over existing conditions, the daylight obstruction value is less than daylight obstruction values in the vicinity of the Project Site, as described below.

#### **6.3.5 Area Context Views**

The area around the Project Site includes low- to mid-rise buildings. To provide a larger context for comparison of daylight conditions, daylight obstruction values were calculated for two Area Context Viewpoints described above and shown in [Figure 6-1](#). The daylight obstruction values range from 68.9 percent for AC1 to 72.9 percent for AC2, both of which are higher than the proposed condition of 44.6 percent.

#### **6.3.6 Conclusion**

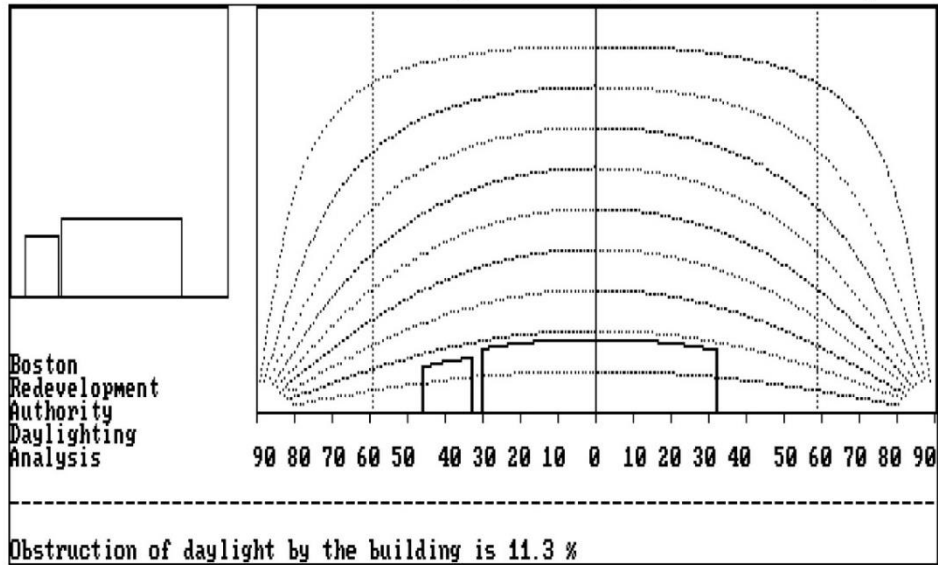
The daylight analysis conducted for the Proposed Project describes existing and proposed obstruction of daylight conditions at the Project Site and in the surrounding area. Results of the BRADA analysis indicate that while development of the Proposed Project will result in increased daylight obstruction values over existing conditions, the resulting conditions will be less than the daylight obstruction values within the surrounding area.

**Figure 6-1 Viewpoint and Area Context Locations**

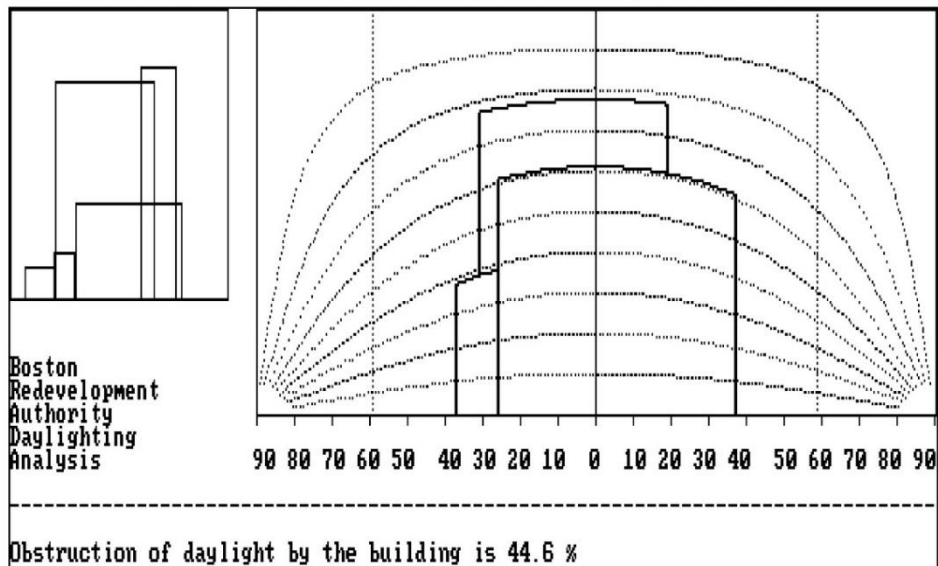


**Figure 6-2 BRADA Output – Existing and Proposed Conditions**

Existing V1: View from the center of Cambridge Street facing north toward the Project Site.



Proposed V1: View from the center of Cambridge Street facing north toward the Project Site.



151 Cambridge Street Boston, Massachusetts

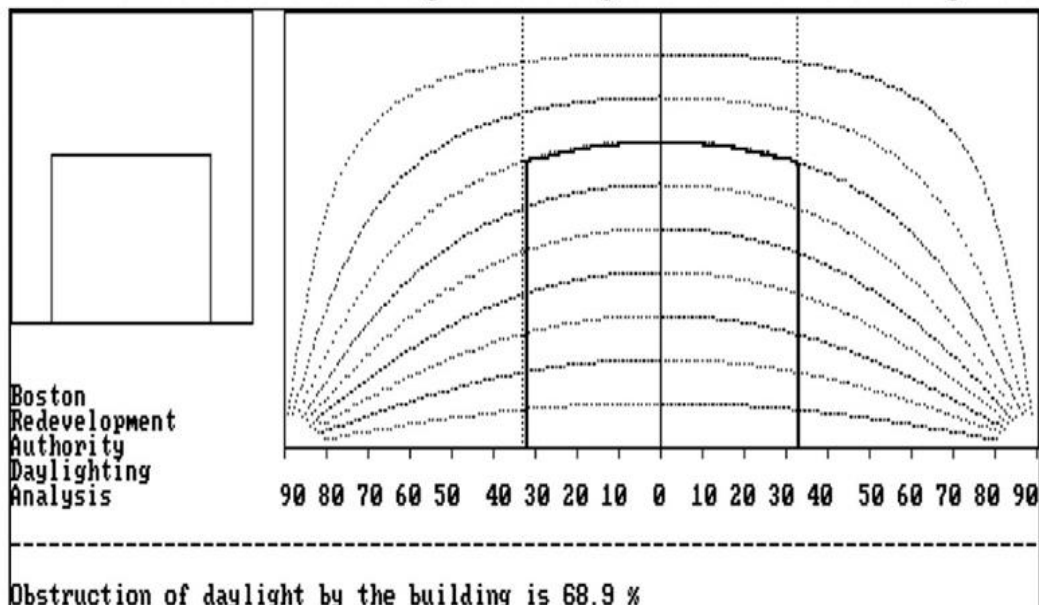
**Epsilon**  
ASSOCIATES INC.

**Figure 2**  
BRADA Output – Existing and Proposed Conditions

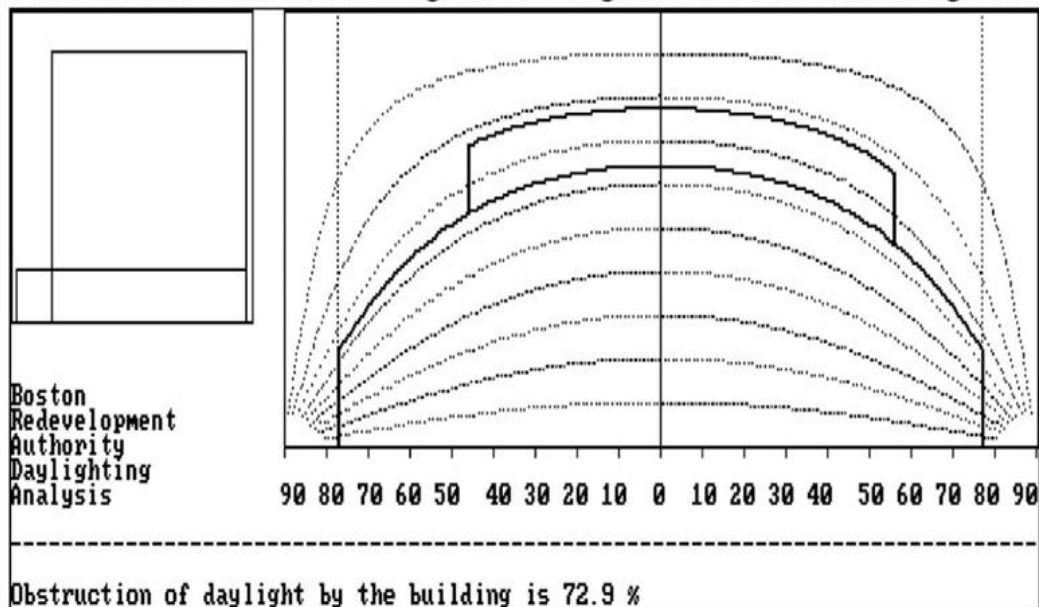


Figure 6-3 BRADA Output – Area Context

AC1: View from the center of Cambridge Street facing south toward 218 Cambridge Street.



AC2: View from the center of Cambridge Street facing south toward 100 Cambridge Street.



151 Cambridge Street Boston, Massachusetts



## **6.4 Solar Glare Analysis**

The Proponent anticipates that the proposed building's exterior materials will primarily consist of non-reflective materials including brick, accent metal, and fiber cement cladding. The first two floors of the building will be constructed with a curtain wall, concentrating in the southern third of the plan and facing the street and buildings to the east and west. Given that the Proponent does not plan to use highly reflective glass or other reflective materials on the building facades, the Proposed Project is not anticipated to result in adverse impacts from reflected solar glare.

## **6.5 Air Quality**

### **6.5.1 Introduction**

This section presents an overview of the air quality assessment completed for the Proposed Project. The results of this assessment demonstrate that the Proposed Project will not result in a violation of applicable local, state, and federal air quality standards.

The Clean Air Act Amendments resulted in states being divided into attainment and nonattainment areas, with classifications based on the severity of their air-quality problems. Air quality control regions are classified and divided into one of three categories: attainment, non-attainment, and maintenance areas, depending upon air quality data and ambient concentrations of pollutants. Attainment areas are regions where ambient concentrations of a pollutant are below the respective National Ambient Air Quality Standards (NAAQS). Non-attainment areas are those where concentrations exceed the NAAQS. A maintenance area is an area that used to be non-attainment but has demonstrated that the air quality has improved to attainment. After 20 years of clean air quality, maintenance areas can be re-designated to attainment. Boston, in Suffolk County, is in attainment for all NAAQS criteria pollutants.<sup>4</sup>

### **6.5.2 Mobile Source Emissions**

The Proposed Project is expected to indirectly result in pollutant emissions from mobile sources due to travel to and from the proposed new building. Emissions from mobile sources are evaluated at two scales in the Article 80B review process: the microscale and the mesoscale. The Planning Department's thresholds for microscale and mesoscale analysis were assessed using the traffic data available in this filing.

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<sup>4</sup> *Non Attainment Areas for Criteria Pollutants (Green Book)*, United States Environmental Protection Agency, <https://www3.epa.gov/airquality/greenbook/cbcs.html#MA>, accessed 11/04/24.

### 6.5.3 Microscale Analysis

The Proposed Project is located in the City of Boston, Suffolk County, Massachusetts, which has been designated as a Carbon Monoxide (CO) Maintenance area by the U.S. Environmental Protection Agency (EPA). Projects located in a CO Maintenance area are required to evaluate their anticipated CO concentrations based on NAAQS. The City of Boston is in attainment for the remainder of the NAAQS criteria pollutants.

### 6.5.4 Air Quality Standards

The EPA has established the NAAQS to protect public health. Massachusetts has adopted similar standards as those set by the EPA for CO. [Table 6-2](#) presents the NAAQS for CO.

**Table 6-2 National Ambient Air Quality Standards**

Pollutant	Primary Standards		
	Level	Averaging Time	Form
Carbon Monoxide	9 ppm (10 mg/m <sup>3</sup> )	8-hour	Not to be exceeded more than once per year
	35 ppm (40 mg/m <sup>3</sup> )	1-hour	

The Massachusetts Department of Environmental Protection (MassDEP) maintains a network of air quality monitors to measure background CO concentrations. Background concentrations are ambient pollution levels from all stationary, mobile, and area sources. Background CO concentrations are determined by choosing the maximum of the second-highest annual values from the previous three years. Looking at the air quality monitor representative of the Project Site (Harrison Avenue) for the years 2021-2023, the CO background values are 1.6 ppm for the 1-hour averaging time and 1.0 ppm for the 8-hour averaging time. These values are much less than the 1-hour and 8-hour NAAQS. The background values are presented in [Table 6-3](#).

**Table 6-3 Air Quality Background Concentrations**

Pollutant	Background Concentrations		NAAQS	
	Level	Averaging Time	Level	Averaging Time
Carbon Monoxide	1.0 ppm	8-hour	9 ppm	8-hour
	1.6 ppm	1-hour	35 ppm	1-hour

*Monitoring Location: Harrison Avenue, Boston, MA. Years 2021-2023.*

The potential CO concentrations from motor vehicle traffic related to the Proposed Project is considered in conjunction with these background concentrations to demonstrate that the Proposed Project complies with the NAAQS Standards.

#### **6.5.5 Boston Planning Department Review Guidelines**

The Planning Department's Development Review Guidelines (the "Development Review Guidelines") require that "a microscale analysis predicting localized carbon monoxide concentrations should be performed, including identification of any locations projected to exceed the National or Massachusetts Ambient Air Quality Standards," for projects when:

- Project traffic would impact intersections or roadway links currently operating at level of service (LOS) D, E, or F or would cause LOS to decline to D, E, or F during typical peak periods;
- Project traffic would increase traffic volumes on nearby roadways by ten percent or more (unless the increase in traffic volume is less than 100 vehicles per hour); or
- The Proposed Project generates 3,000 or more new average daily trips on roadways providing access to a single location.

#### **Microscale Screening Analysis**

An evaluation of the traffic data for the Proposed Project was conducted under the Development Review Guidelines. It was determined that:

- The Proposed Project would not cause a decline in LOS at any signalized intersection in the study area during any time period. The Proposed Project is expected to generate a negligible number of vehicle trips, such that a traffic operations analysis is not warranted. These minimal trips are not expected to impact traffic operations in the surrounding network or increase traffic delays. As the Proposed Project will not substantially impact any intersections operating at a LOS D, E, or F, the Proposed Project does not exceed the first criterion.
- The Proposed Project is expected to generate approximately three (3) net new vehicle trips in the weekday morning peak hour and approximately five (5) vehicle trips in the weekday evening peak hour. Since anticipated traffic volume increases are less than 100 vehicles per hour at peak hours, the Proposed Project does not exceed the second criterion.

- The Proposed Project is expected to generate approximately eight (8) net new daily vehicle trips (on weekdays). Therefore, the Proposed Project does not exceed the third criterion.

Based on the microscale screening results discussed above, it has been determined that a quantitative CO hotspot analysis is not required for the Proposed Project and that no microscale air quality impacts are anticipated.

#### **6.5.6 Mesoscale Analysis**

The purpose of the mesoscale analysis is to estimate the area-wide emissions of Volatile Organic Compounds (VOC) and Nitrogen Oxides (NO<sub>x</sub>) during a typical day in the peak ozone season (summer) consistent with the requirements of the State Implementation Plan (SIP). A mesoscale analysis evaluates the change in VOC and NO<sub>x</sub> emissions from average daily traffic volumes and vehicle emission rates. To demonstrate compliance with the SIP criteria, the air quality study must show the proposed project's change in daily (24-hour period) VOC and NO<sub>x</sub> emissions. The Planning Department requires a mesoscale air quality analysis if a proposed project produces 10,000 or more vehicle trips per day. The Proposed Project is expected to generate approximately eight (8) net new daily vehicle trips (on weekdays), which means the mesoscale analysis threshold is not triggered.

#### **6.5.7 Stationary Source Emissions**

Stationary source emissions typically occur from on-site combustion from building mechanical equipment and from parking garages as outlined by the Development Review Guidelines.

The Proposed Project is not expected to be a substantial source of pollutant emissions from building stationary sources. The Proposed Project is proposing the construction of a residential building a two-story public library space. The Proponent is committed to these buildings being fully electric by electrifying both the space heating and water heating equipment. The current design intends to achieve this through central variable refrigerant flow (VRF) space heating and air source heat pump water heaters. This commitment means that there will be no combustion emissions from these end uses at the Proposed Project. Additionally, the Proposed Project is committed to achieving Passive House Certification, meaning the building will be designed to achieve substantial energy efficiency.



The proposed new building is expected to be served by a fossil fuel emergency generator which is restricted by MassDEP in the number of hours they may run per year, including periodic testing maintenance. All combustion emissions would be released from at least 10 feet above the generator to reduce any impact to ground-level or nearby sensitive receptors. As such, HVAC and mechanical emissions are not expected to be significant nor cause air quality impact to any pedestrians or sensitive receptors.

Sizeable combustion equipment with the potential to emit air pollutants at the Proposed Project may be subject to air permitting under 310 CMR 7.00. MassDEP has established the “Environmental Results Program” (ERP) to streamline the certification process of smaller combustion equipment subject to permitting regulations. The exact sizes, makes, and models of equipment to be used by the Proposed Project are currently unknown and will be determined throughout the design process. However, equipment that is likely to be used at the Proposed Project, such as emergency generators based on the current design, may be subject to permitting regulations. If an emergency generator with a rated capacity equal to or greater than 37 kW is used on the Project Site, the Proponent will submit the appropriate self-certification forms under the ERP process within 60 days of generator startup. Through the ERP process, the Proponent will need to conduct an air quality assessment to ensure that the use of this equipment will not exceed any state or federal standards such as NAAQS.

The Proponent has held discussions with HNE, the owner of the Otis House, and has confirmed that HNE is amenable to the removal of the existing 14 surface parking spaces to establish an enhanced public realm between the Project Site and the Otis House. The Proponent will continue to collaborate with HNE to coordinate this matter. No new on-site parking is proposed. As such, pollutant emissions from parking lots or garages are not anticipated.

## **6.6 Noise Analysis**

### **6.6.1 Introduction**

This section summarizes the noise analysis conducted for the Proposed Project. As described below, the Proposed Project has been designed to comply with applicable local and state regulations and is not anticipated to create unreasonable or excessive noise.

### **6.6.2 Massachusetts Regulation**

310 CMR 7.10 prohibits facilities from creating a condition of noise pollution. MassDEP policy provides that a noise source will violate this regulation if the source:

- Increases the broadband sound level by more than 10 dBA above the ambient level;  
or
- Produces a “pure tone” condition – when any octave band center frequency sound pressure level exceeds the two adjacent center frequency sound pressure levels by 3 decibels or more.

These criteria are measured both at the property line and at the nearest inhabited residence. “Ambient” is defined as the background A-weighted sound level that is exceeded 90% of the time, measured during equipment operating hours, but may also be established by other means with consent of the MassDEP.

### **6.6.3 City of Boston Regulations**

The City of Boston Regulations for the Control of Noise (the “City Noise Regulations”) impose specific limits on unreasonable or excessive noise given in the form of broadband sound levels. These regulations state that in residential zones, no noise shall be made or emitted which results in sound levels at adjacent properties in excess of 50 dBA between the hours of 6 PM and 7 AM and on Sundays, and at all other times noise levels at adjacent properties shall not exceed 60 dBA. Noise emitted to business districts may not exceed 65 dBA at any time.

The nearest properties to the Proposed Project are all considered business zones, with the nearest residential properties located across Cambridge Street.

### **6.6.4 Existing Conditions Survey**

Acentech installed sound level meters at the Project Site between September 25 and October 3, 2024, to quantify the ambient noise levels. One meter was located in the garden in front of the existing library building facing Cambridge Street, and the other meter was located in the rear parking lot.

Subjectively speaking, the noise levels at the Cambridge Street meter position were dominated by street noise, while the noise levels at the parking lot were controlled by mechanical

equipment noise, especially equipment on the nearby low roof serving the Charles River Plaza Whole Foods.

The results of the existing conditions survey are shown on [Figures 6-4](#) and [6-5](#) below. Levels are presented in terms of the hourly A-weighted 90<sup>th</sup> percentile level, or LA90, which is used to define the ambient level according to the MassDEP noise regulation, as well as the A-weighted 50<sup>th</sup> and 10<sup>th</sup> percentile levels (LA50 and LA10, respectively). The LA10 is the level exceeded for the loudest 10% of the measurement period (in this case one hour) and is used to describe louder, short term noises, and the LA50 is the median sound level during each hour.

The ambient sound levels (LA90) at the Cambridge Street measurement position were between 57 and 62 dBA, while the ambient levels at the parking lot position were between 67 and 70 dBA. Note that the ambient level range and differences between the three different metrics are much smaller at the parking lot meter position than at the Cambridge Street position. This is because the sound levels at the rear are controlled by the nearby mechanical equipment, which is always on, while the sound levels at the front vary much more widely as cars and trucks drive by.

Since the ambient levels (the LA90) were above 55 dBA for the entire measurement period, the City of Boston noise regulation will be the more stringent criteria in terms of the overall noise level. However, the Proposed Project will also need to be designed to avoid creating “pure tone” conditions as described in the MassDEP regulation.

#### **6.6.5 Summary of New Equipment**

Outdoor mechanical equipment for the Proposed Project will be located in a mechanical penthouse on the level 15 roof, surrounded by a screen wall. The new equipment is as follows:

- Two (2) DOAS units: Addison PROH size 420 D4
- Three (3) heat pumps: Enerblue HPL90
- Five (5) VRF condenser units: Daikin REYQ288
- Dryer exhaust fan: LFSsystems T9F100
- Two (2) stair pressurization fans: Greenheck USF-24 and USF-36
- Emergency generator: Cat C18 600KW

#### **6.6.6 Noise Control Strategies**

Noise control for rooftop equipment to nearby properties will primarily be provided by the screen wall around the penthouse. The wall is solid at the east façade (towards Massachusetts Eye and Ear Institute) and the south façade (toward Cambridge Street), with louvers at the north façade (towards Massachusetts General Hospital and the northern part of the west façade (towards Charles River Plaza). The wall is drawn with the top at 13'6" above the roof level, and the material is described as a "metal panel".

In order to block sound effectively, it is recommended that the solid portions of the screen wall are at least 5 pounds per square feet, although panels with a surface weight down to 2psf may be acoustically acceptable. Accordingly, the project team will determine the effectiveness of the panels and incorporate changes as necessary. To reduce sound buildup on the roof due to reflections off the inside of the screen walls, it is recommended that hanging exterior grade absorption such as SoundSeal QFA-14 on the inside of the screen walls. If necessary, this hanging panel can be combined with a mass layer to improve the sound blocking performance of the screen wall.

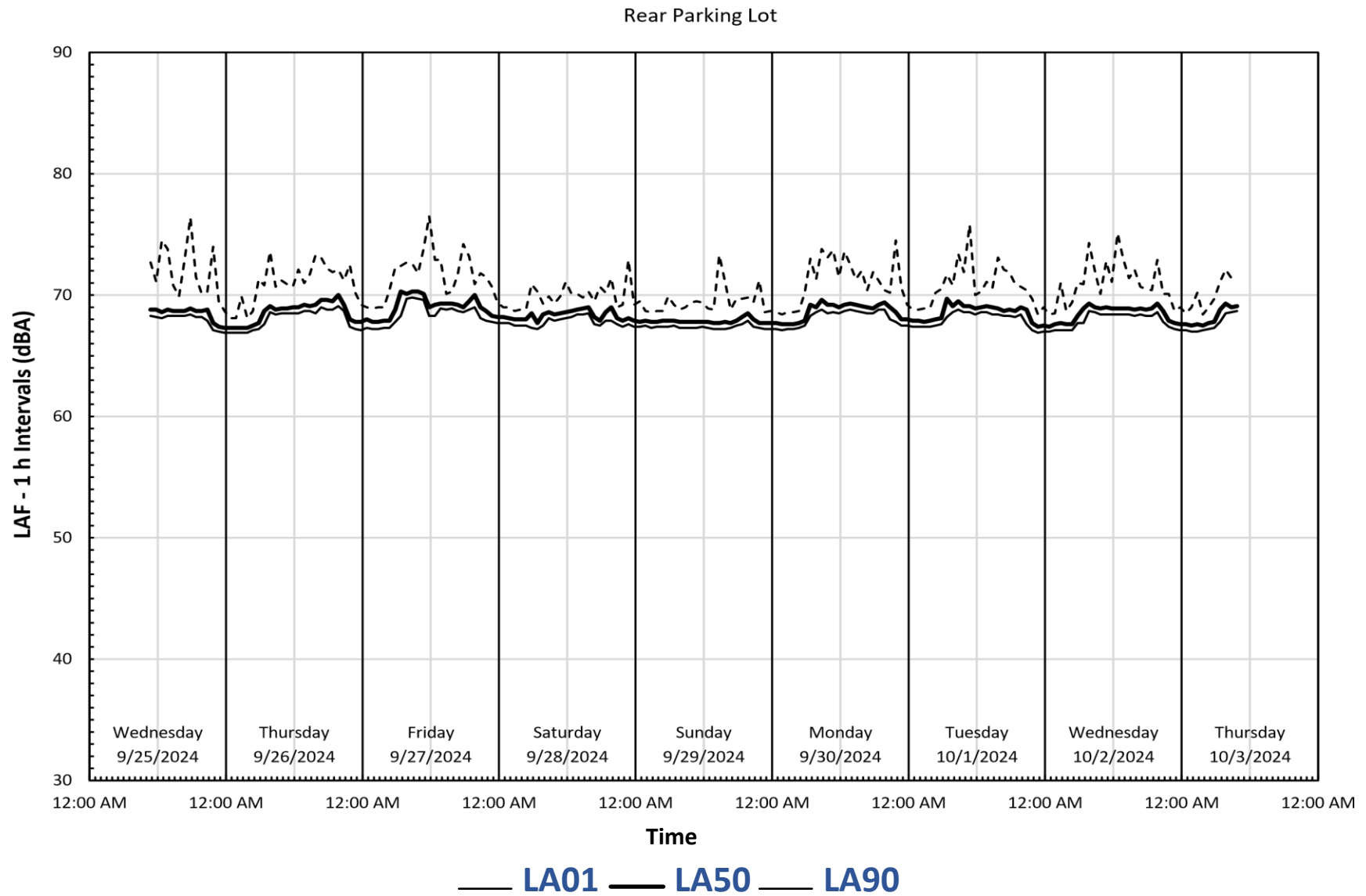
Assuming that the screen wall construction is appropriate for blocking sound, and without the emergency equipment running, this analysis predicts sound levels of approximately 45 dBA at the upper levels of 181 Cambridge Street to the north, approximately 50 dBA at 165 Cambridge Street to the west, and approximately 41 dBA at Massachusetts Eye and Ear to the east. Sound levels at the Otis House and any residences across Cambridge Street will be lower. These predicted levels include all non-emergency equipment running at full capacity.

When the emergency equipment is added, the levels rise to 61 dBA at 181 Cambridge Street, 72 dBA at 165 Cambridge Street, and 61 dBA at MEEI. These levels are driven primarily by the generator, which for these calculations was assumed to have only a weather enclosure (not sound rated). To mitigate these noise levels, the generator will be located within a sound attenuation enclosure so that the regular testing does not exceed the City of Boston noise regulation limits. If the generator is provided with the SA Level 1 Canopy, these levels decrease to 50 dBA at 181 Cambridge Street, 59 dBA at 165 Cambridge Street, and 46 dBA at MEEI. These levels comply with the City Noise Regulations.

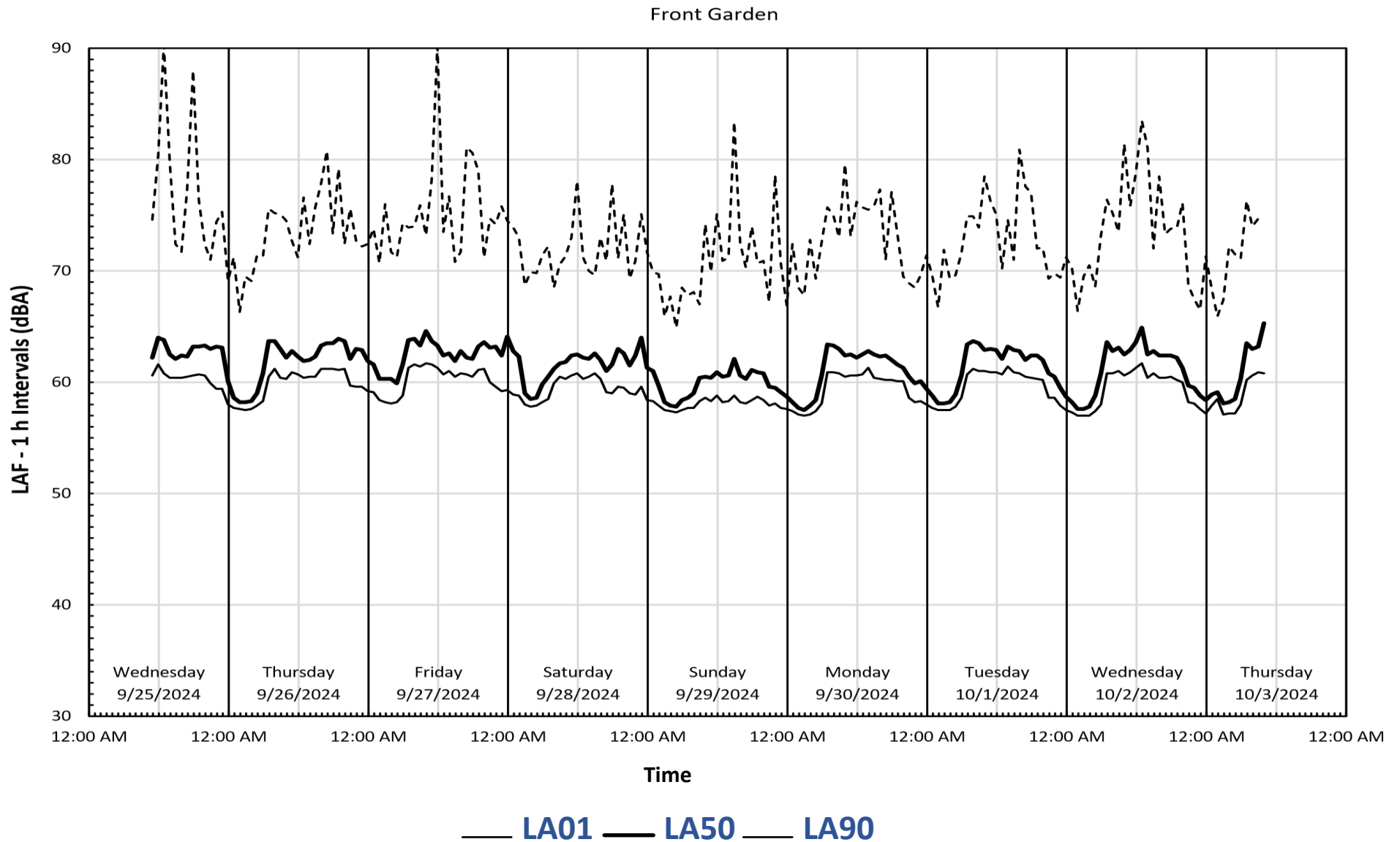
Based on octave-band sound data (all units except the VRF condensing units), the Proposed Project is not anticipated to create any “pure tone” conditions as defined by the MassDEP regulation. Based on the overall levels, even if the VRF units alone produce a “pure tone”, the level will be low enough that it will be masked by other equipment noise and will not result in a “pure tone” condition at nearby receivers.



Figure 6-4 Sound Levels Measured at Back of Site



**Figure 6-5 Sound Levels Measured at Cambridge Street**



## **6.7 Infrastructure Systems**

### **6.7.1 Introduction**

This chapter outlines the existing utilities surrounding the Project Site, the connections required to provide service to the Proposed Project, and any impacts on the existing utility systems that may result from the construction of the Proposed Project. The following utility systems are discussed herein:

- Sewer
- Domestic water
- Fire protection
- Drainage
- Natural gas
- Electricity
- Telecommunications

### **6.7.2 Wastewater**

#### **6.7.2.1 Existing Sewer Infrastructure**

There is an existing Boston Water and Sewer Commission (BWSC) dedicated 10-inch combined sewer main in Cambridge Street which flows in the westerly direction before joining a 30 by 54-inch combined sewer main in Cambridge Street that eventually connects into the Brookline sewer system which ultimately flows to the MWRA Deer Island Wastewater Treatment Plant for treatment and disposal.

#### **6.7.2.2 Wastewater Generation**

The Project Site currently contains an existing library building of approximately 7,240 square feet. 310 CMR 15.00 lists typical sewage generation values for the existing use and the Proposed Project's uses, as shown in [Table 6-4](#). Since 310 CMR 15.00 does not provide a sewage generation value for library use, [Table 6-4](#) includes sewage generation values for office use instead, for reference purposes only. As shown in [Table 6-4](#), the Proposed Project is expected to generate an increase in wastewater flows of approximately 23,432 gallons per day compared to existing conditions. The building program and the sewage generation are subject to I/I requirements due to exceeding a 15,000 gallons per day increase over existing conditions. The 4:1 I/I calculations will be provided to BWSC as required by BWSC policies. This fee will be paid to the BWSC at least 90 days before the domestic water service is activated to the new building.

**Table 6-4 Proposed Project Wastewater Generation**

Use	Size/Unit	310 CMR Value (gpd/unit)	Total Flow (gpd)
<b>Existing Building Program</b>			
Office (Library)	7,240 SF	75/1,000/SF	543
<b>Total Existing Sewer Flows</b>			<b>543</b>
<b>Proposed Residential Building (using average 310 CMR values)</b>			
Office (Library)	19,000 SF	75/1,000 SF	1,425
Residential	205 Bedrooms	110/bedroom	22,550
<b>Total Proposed Sewer Flows</b>			<b>23,975</b>

<b>Increase in Sewer Flows (gpd):</b>	<b>23,432</b>
---------------------------------------	---------------

### 6.7.2.3 Sewage Capacity and Impacts

The Proposed Project's anticipated impacts on the existing BWSC sewer mains in Cambridge Street were analyzed. [Table 6-5](#) below indicates the hydraulic capacity of the existing 10-inch combined sewer main in Cambridge Street. The minimum hydraulic capacity is 2.45 million gallons per day (MGD) or 3.80 cubic feet per second (CFS) for the 10-inch main.

Based on an average daily flow estimate for the Proposed Project of 23,975 GPD or 0.02397 MGD, and with a factor of safety estimate of 10 (total estimate = 0.02397 MGD x 10 = 0.2397 MGD), the BWSC sewer systems in Cambridge Street will have sufficient capacity to accommodate the sanitary flows resulting from the Proposed Project.

**Table 6-5 Sewer Hydraulic Capacity Analysis**

Manhole (BWSC Number)	Distance (feet)	Invert Elevation (up)	Invert Elevation (down)	Slope (%)	Dia. (in)	Manning's Number	Flow Capacity (cfs)	Flow Capacity (MGD)
<b>Cambridge Street</b>								
27 to 59	256	16.80	8.90	3.08%	10	0.013	3.80	2.45
<b>Minimum Flow Analyzed:</b>							<b>3.80</b>	<b>2.45</b>

- Notes:
1. Manhole numbers and inverts taken from BWSC Sewer system GIS Map received on October 24, 2024 and included as [Figure 6-6](#).
  2. Flow Calculations based on Manning Equation

#### **6.7.2.4 Proposed Project**

The Proponent will coordinate with the BWSC on the design and capacity of the proposed connections to the sewer system. Approval for the increase in sanitary flow will come from the BWSC.

New sewer services for the Proposed Project will connect to the existing combined sewer main in Cambridge Street.

Improvements and connections to BWSC infrastructure will be reviewed as part of the BWSC's Site Plan Review process for the Proposed Project. This process will include a comprehensive design review of the existing and proposed service connections, an assessment of project demands and system capacity, and the establishment of service accounts.

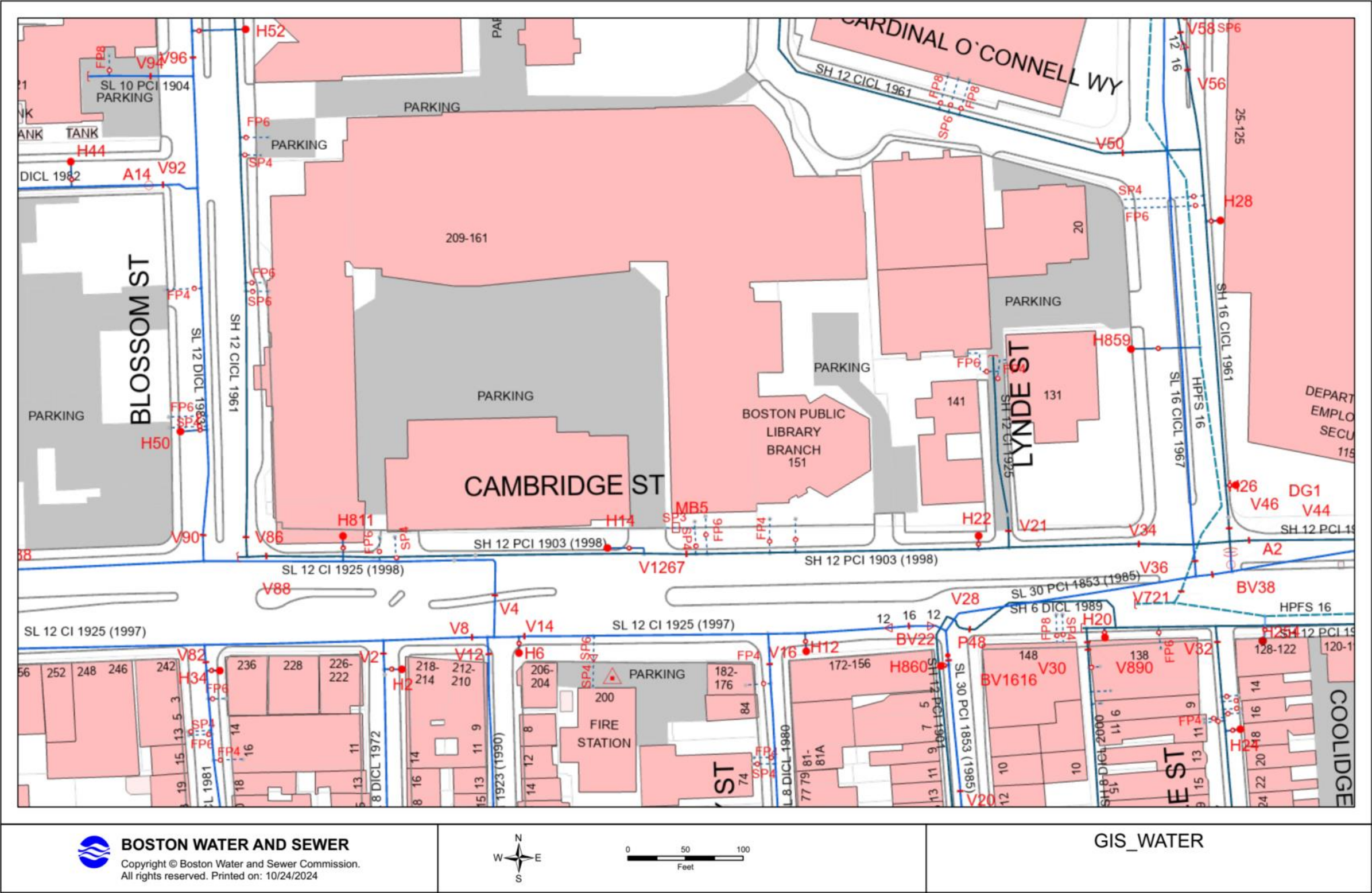
#### **6.7.2.5 Water Supply**

##### **6.7.2.5.1 Water Infrastructure**

Water for the Proposed Project will be provided by the BWSC. There are five water systems within the City, and these systems provide service to portions of the City based on ground surface elevation. The five systems are southern low (commonly known as low service), southern high (commonly known as high service), southern extra high, northern low, and northern high. The water main servicing Cambridge Street is a 12-inch southern high main. The existing water system is illustrated in [Figure 6-6](#).



Figure 6-6 BWSC Sewer System GIS Map



**6.7.2.6 Water Consumption**

The Proposed Project’s water demand estimate for domestic services is based on the Project’s estimated sewage generation, described above. A conservative factor of 1.1 (10%) is applied to the estimated average daily wastewater flows calculated with 314 CMR 15.00 values to account for consumption, system losses and other usages to estimate an average daily water demand. The Proposed Project’s estimated domestic water demand is 26,372 gpd. The water for the Proposed Project will be supplied by the BWSC systems in Cambridge Street.

**6.7.2.7 Existing Water Capacity and Impacts**

BWSC record flow test data containing actual flow and pressure for hydrants within the vicinity of the Project Site was requested by the Proponent. Hydrant flow data was available for one hydrant near the Project Site. The existing hydrant flow data is shown in [Table 6-6](#).

*Table 6-6 Existing Hydrant Flow Data*

Flow Hydrant Number	Date of Test	Static Pressure (psi)	Residual Pressure	Total Flow
H14	7/14/2021	102	80	1,228

Note: Data provided by BWSC on November 15, 2024

Water capacity problems are not anticipated within this system as a result of the Project’s construction.

**6.7.2.8 Proposed Project**

The domestic and fire protection water services for the Proposed Project will connect to the existing BWSC water main in Cambridge Street.

The Proposed Project’s impacts to the existing water system will be reviewed as part of the BWSC’s Site Plan Review process.

The domestic and fire protection water service connections required for the Proposed Project will meet the applicable City and State codes and standards, including cross-connection backflow prevention. Compliance with the standards for the domestic water system service connection will be reviewed as part of BWSC’s Site Plan Review Process. This review will include sizing of domestic water and fire protection services, calculation of meter sizing, backflow prevention design, and location of hydrants and Siamese connections that conform to BWSC and Boston Fire Department requirements.

Efforts to reduce water consumption will be made as described above in this PNF. Aeration fixtures and appliances will be chosen for water conservation qualities. If there are public restrooms, sensor operated faucets and toilets will be installed.

New water services will be installed in accordance with the latest local, state, and federal codes and standards. Backflow preventers will be installed at both domestic and fire protection service connections. New meters will be installed with Meter Transmitter Units (MTU's) as part of the BWSC's Automatic Meter Reading (AMR) system.

### **6.7.3 Stormwater**

#### **6.7.3.1 Existing Stormwater Infrastructure**

There is an existing 12-inch BWSC storm drain main in Cambridge Street that flows westerly into an 18-inch BWSC storm drain in Cambridge Street, which flows westerly before connecting to a 30x54-inch combined sewer main in Cambridge Street. The existing BWSC storm drain system is illustrated in [Figure 6-6](#) above.

Stormwater at the Project Site is currently captured by catch basins and roof drains that direct the surface runoff to the main in Cambridge Street.

#### **6.7.3.2 Proposed Project**

Stormwater improvements will be reviewed as part of the BWSC Site Plan Review process. This process includes a comprehensive design review of the proposed service connections, assessment of Project demands and system capacity, and establishment of service accounts. The proposed management system will collect site runoff and 1.25 inches of rainfall over the Proposed Project's impervious area per BWSC requirements. The Proposed Project's storm drainage system will discharge to the BWSC storm drain in Cambridge Street.

Site runoff will be collected by a closed drainage system and treated before overflowing to the BWSC storm drainage system.

All work on the drainage systems will be performed in accordance with BWSC standards and will be submitted to the necessary agencies for review and approval prior to implementation.

#### **6.7.3.3 Stormwater Measures During Construction**

The Proposed Project will not affect the water quality of nearby water bodies. Erosion and sediment control measures will be implemented during construction to minimize the

transport of site soils to off-site areas and BWSC storm drain systems. During construction, existing catch basins will be protected with filter fabric, straw bales and/or crushed stone, to provide for sediment removal from runoff. These controls will be inspected and maintained throughout the construction phase until the areas of disturbance have been stabilized through the placement of pavement, structure, or vegetative cover.

All necessary dewatering will be conducted in accordance with applicable MWRA and/or BWSC discharge permits. Once construction is complete, the Proposed Project will be operated in compliance with local and state stormwater management policies, as described below.

#### **6.7.3.4 Groundwater Recharge Measures/Smart Utilities**

The following sections summarize the approach to addressing the City of Boston's Smart Utilities Policy as applicable to the Proposed Project. Additional information is provided in the Smart Utilities Checklist in [Appendix C](#) of this PNF.

The Proposed Project consists of more than 100,000 square feet of floor area, and therefore will be required to infiltrate the first 1.25 inches of rainfall over the site impervious area. This will be accomplished primarily through an underground infiltration system. The infiltration system will likely consist of open-bottomed chambers and/or perforated pipes in a bed of crushed stone sized to store the 1.25-inch volume before overflowing by gravity to the storm drain in Cambridge Street. Stormwater from the roof and site impervious areas will be directed to the infiltration system through a closed drainage system.

#### **6.7.3.5 MassDEP Stormwater Management Policy Standards**

In March 1997, MassDEP adopted a Stormwater Management Policy to address non-point source pollution. In 1997, MassDEP published the Massachusetts Stormwater Handbook as guidance on the Stormwater Policy, which was revised in February 2008. The Policy prescribes specific stormwater management standards for development projects, including urban pollutant removal criteria for projects that may impact environmental resource areas. Compliance is achieved through the implementation of Best Management Practices (BMPs) in the stormwater management design. The Policy is administered locally pursuant to MGL Ch. 131, s. 40.

A brief explanation of each Policy Standard and the system compliance is provided below:

**Standard #1:** *No new stormwater conveyances (e.g., outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

**Compliance:** The Proposed Project will comply with this Standard. The design will incorporate the appropriate stormwater treatment and no new untreated stormwater will be directly discharged to, nor will erosion be caused to wetlands or waters of the Commonwealth as a result of stormwater discharges related to the Proposed Project.

**Standard #2:** *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR.*

**Compliance:** The Proposed Project will comply with this Standard. The existing discharge rate will be met or decreased as a result of the improvements associated with the Proposed Project.

**Standard #3:** *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.*

**Compliance:** The Proposed Project will comply with this Standard to the maximum extent practicable.

**Standard #4:** *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:*



- a. *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
- b. *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
- c. *Pre-treatment is provided in accordance with the Massachusetts Stormwater Handbook.*

**Compliance:** The Proposed Project will comply with this Standard. Within the Proposed Project's limit of work, there will be mostly building roof, paved sidewalk, parking, and roadway areas. Runoff from paved areas that would contribute unwanted sediments or pollutants to the existing storm drain system will be collected by deep sump, hooded catch basins and conveyed through water quality units before discharging into the BWSC system.

**Standard #5:** *For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the Proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.*

**Compliance:** The Proposed Project will comply with this Standard. The Proposed Project is not associated with Higher Potential Pollutant Loads (per the Policy, Volume I, page 1-6).

**Standard #6:** *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or close to any other critical area,*

*require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account any site-specific factors. Stormwater discharges to*

*Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A “storm water discharge” as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water and Special Resource Water shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment.*

*A “storm water discharge” as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource*

*Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.*

**Compliance:** The Proposed Project will comply with this Standard. The Proposed Project will not discharge untreated stormwater to a sensitive area or any other area.

**Standard #7:** *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*

**Compliance:** The Proposed Project is a new development and thus this Standard is not applicable.

**Standard #8:** *A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

**Compliance:** The Proposed Project will comply with this Standard. Sedimentation and erosion controls will be incorporated as part of the design of the Proposed Project and employed during construction.

**Standard 9:** *A Long-Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

**Compliance:** The Proposed Project will comply with this Standard. An O&M Plan including long-term BMP operation requirements will be prepared for the Proposed Project and will assure proper maintenance and functioning of the stormwater management system.

**Standard 10:** *All illicit discharges to the stormwater management system are prohibited.*

**Compliance:** The Proposed Project will comply with this Standard. There will be no illicit connections associated with the Proposed Project.

#### **6.7.4 Electrical Service**

The Proponent will work with National Grid to identify where proposed building electrical services will connect and to confirm adequate system capacity as the design is finalized.

#### **6.7.5 Telecommunications Systems**

Telecommunication service will be coordinated with the telecommunication providers.

#### **6.7.6 Gas Systems**

No gas systems are being proposed.

### **6.8 Flood Hazard Zones/Wetlands**

The FEMA Flood Insurance Map (FIRM) for the Project Site (Parcel 25025C0077K) indicates that the Proposed Project is located in a Zone X area determined to be outside of the 0.2% annual chance flood plan. The Project Site is previously developed and does not contain wetlands.

## 6.9 **Geotechnical Impacts**

### 6.9.1 **Introduction**

This section includes a description of the anticipated subsurface soil and groundwater conditions at the Project Site, planned foundation construction activities, mitigation measures during foundation and below-grade construction, as well as potential impacts during foundation and below-grade construction.

### 6.9.2 **Subsurface Soil and Bedrock Conditions**

Based on available subsurface data, the general Project Site subsurface profile is listed below in [Table 6-7](#), in order of increasing depth below ground surface.

*Table 6-7 Subsurface Soil and Bedrock Conditions*

Generalized Subsurface Strata	Approximate Thickness (Feet)
Miscellaneous Fill	5 – 6
Glacial Outwash	26.5 – 43
Marine Sand	2.5 – 11.5
Glacial Till and Glaciomarine Deposits	2 – 18.5
Bedrock	--

### 6.9.3 **Groundwater Conditions**

Groundwater levels in the vicinity of the Project Site are expected to be at depths ranging from 25.5 feet to 27 feet below ground surface, corresponding to about Elevation +3.2 to Elevation +4.2 on the Boston City Base (BCB) datum. Groundwater levels in the area could be influenced by normal seasonal changes, runoff during or following periods of heavy precipitation, and alterations of existing drainage patterns.

### 6.9.4 **Proposed Foundation Construction**

The Proposed Project includes the construction of 14-story building with a partial basement. Foundation support for the proposed building will be provided by two (2) types of foundation systems bearing in the glacial outwash deposit: footings and/or structural mats for support of the portion of the building with a basement level, and drilled-in micropiles for the portion of the building located outside the footprint of the basement level. Since the majority of the first floor, lowest level slab will be approximately coincident with the finished grade, underslab or perimeter foundation drains are not anticipated to be required. Underslab and perimeter foundation drainage should be provided for the proposed basement. Specifically, perimeter

and underslab foundation drains are recommended in areas where the new slabs are proposed to be 18 inches or more below surrounding grades. The perimeter and underslab foundation drains are intended to minimize groundwater intrusion into the below-grade space due to conditions when groundwater may become temporarily elevated due to precipitation events, surface water run-off, and/or seasonal groundwater changes. The underslab and perimeter drainage systems are not intended to lower the existing groundwater level.

Based on the existing site grades and the proposed basement elevations, cuts ranging from about 13 to 20 feet below existing ground surface will be required to construct the proposed below-grade level, including the elevator pit. It is anticipated that temporary excavation support will be required along all four sides of the basement excavation. The temporary excavation support system is likely to consist of a cantilevered drilled-in steel soldier pile and timber lagging wall.

Based on the anticipated depth to the groundwater level at the Project Site and the anticipated depth of excavation, it is not anticipated that groundwater will be encountered during foundation construction. However, temporary dewatering may be required to remove “free” water from the soils due to precipitation.

On-site recharge is anticipated to be feasible to handle the relatively nominal amount of water collected from the excavation. If off-site discharge becomes necessary for the Proposed Project, a temporary construction dewatering permit will be obtained from governing agencies prior to discharge of dewatering effluent from the Project Site. Testing of the effluent will be conducted prior to and during off-site discharge, if required, to confirm compliance with all permit requirements.

In summary, the foundation design and construction will be specified and conducted to limit potential adverse impacts to the surrounding properties, especially to adjacent structures and to groundwater levels.

#### **6.9.5 Mitigation Measures**

Mitigation measures will be incorporated into the design and construction documents to limit potential adverse impacts, including the following:

- The design team will conduct studies, prepare designs and specifications, and review contractor's submittals for conformance to the Project contract documents with



specific attention to protection of nearby structures and facilities and to avoid significant lowering of the preconstruction groundwater level. In particular, selection of the building foundation and excavation support systems and their details will be made with specific attention to mitigating adverse temporary and long-term impacts outside the site.

- Performance criteria (threshold and limiting values) will be established in the Project specifications for the lateral excavation support systems with respect to control of lateral movements. The contractor will be required to develop, employ, and modify as necessary, construction means and methods and take all necessary steps during the work to protect nearby buildings and other facilities. Soldier piles will be recommended to be drilled-in, as opposed to driven, to reduce noise and vibration impacts to adjacent structures. The contractor will also be required to submit for review a lateral excavation support design, including calculations and drawings prepared and stamped by a professional engineer who is registered in the Commonwealth of Massachusetts and employed by the Contractor.
- Geotechnical instrumentation will be installed and monitored during the work to observe the performance of the lateral earth support system and adjacent buildings and structures.
- Preconstruction condition surveys will be conducted, as needed, on buildings adjacent to the site to establish existing building conditions prior to the commencement of construction.
- A vibration monitoring program will be implemented to document construction phase vibrations. Vibration levels will be monitored, as needed, at various locations at and/or adjacent to the site during installation of the lateral earth support system, basement excavation, micropile installation, or other potentially vibration-causing activities for conformance with the project documents. Vibration threshold values will be established in the Project specifications.

- The Project Site is not located within the Groundwater Conservation Overlay District (GCOD). Excavation below the groundwater level is not anticipated, and therefore monitoring of groundwater levels likely will not be necessary.

#### **6.9.6 Potential Impacts During Excavation and Foundation Construction**

Some ground vibrations and noise may be produced because of demolition and installation of an engineered lateral earth support system. Impacts from these vibrations are not anticipated to result in damage to adjacent structures but may be noticeable by the abutters. To monitor vibration levels and to assess the potential impacts of demolition and installation of an engineered lateral earth support system, vibration monitoring with seismographs will be performed.

### **6.10 Solid And Hazardous Waste**

#### **6.10.1 Introduction**

This section highlights the environmental conditions identified in the Phase I Environmental Assessment of the Project Site.

#### **6.10.2 Existing Hazardous Waste Conditions**

A Phase I Environmental Assessment of the Project Site was prepared in July 2024. The report identified no Recognized Environmental Conditions (RECs) associated with the Project Site.

#### **6.10.3 Operational Solid Waste and Recycling**

Abatement and disposal of hazardous materials (or hazardous waste), if encountered, will be performed under the provisions of MGL Ch. 21, s. 2C, Occupational Safety and Health Administration (OSHA) requirements, and the Massachusetts Contingency Plan (MCP) by specialty contractors experienced and licensed in handling materials of this nature.

It is currently anticipated that construction of the proposed building and site improvements will require excavation and off-site disposal of excess soil resulting from basement/foundation excavation. The Proponent will retain a Licensed Site Professional (LSP) to manage the environmental aspects of the Proposed Project, including proper management and/or disposal of soil encountered during construction. Disposal of excess excavated soil will be conducted in accordance with applicable MassDEP policies. Chemical testing of soil samples will be performed as needed to reuse/dispose of the soils off-site based on the acceptance criteria of specific facilities. The soils transported off site will be legally reused/disposed in accordance

with the MCP and other regulatory requirements. Disposal of materials will be tracked via Material Shipping Records, Bills of Lading and/or other methods, as required to ensure their proper and legal disposal.

In the event that compounds are detected in soil during the above-referenced testing at concentrations above applicable MassDEP reporting standards, the release condition will be reported to MassDEP. Further remedial activities, if necessary, will be conducted in accordance with the MCP and applicable MassDEP policies.

Asphalt pavement, brick, and concrete (ABC) rubble generated from demolition of the exiting building, site walkways and structures will be handled in accordance with applicable MassDEP solid waste policies. The Proposed Project's disposal contract will include specific provisions for the segregation, reprocessing, reuse, and/or recycling of building materials and demolition debris. Those materials will be transported in covered trucks to an approved solid waste facility per applicable MassDEP solid waste policies.

Abatement and disposal of hazardous materials (or hazardous waste), if encountered, will be performed under the provisions of MGL Ch. 21, s. 2C, OSHA requirements, and the MCP by specialty contractors experienced and licensed in handling materials of this nature.

## **6.11 Construction Impacts**

### **6.11.1 Introduction**

The Construction Manager (CM) will administer the Construction Management Plan (CMP) and will enforce the provisions of the CMP with all contractors, subcontractors, suppliers, and vendors participating in the Proposed Project throughout the construction process. Upon approval, the CMP will become an exhibit to the subcontracts and each subcontractor will be contractually obligated to abide by the approved CMP.

Compliance with the CMP will be monitored through field inspections, meeting minutes, and periodic updates as mandated by the City of Boston and any other authority having jurisdiction. The CM will have a presence on the Project Site for all days that construction activity is taking place.

### **6.11.2 Construction Air Quality**

Construction activities will potentially generate fugitive dust, which could result in a localized increase in airborne particulate levels. Fugitive emissions from construction activities will depend upon a multitude of factors such as ambient humidity, recent weather patterns, and phase of construction. The Construction Manager will be required to implement measures to control odors if needed. These measures may include spraying of odor control foams, limiting the amount of open excavation at any one time, and use of odor neutralizers.

### **6.11.3 Rodent Control**

The Construction Manager will develop a Rodent Control Program for the Proposed Project prior to its construction start. A Pest Control Service will be hired as the manager of the Rodent Control Program. Rodent control measures will be in-place prior to and during demolition and construction activities. The program will include performance of extermination and control procedures. The Pest Control contractor has been hired to conduct weekly site visits. Additionally, waste containers will be placed at worker gathering locations and emptied on a daily basis. Litter clean-up will be performed on a daily basis.

### **6.11.4 Construction Activity Schedule**

The typical construction activity will occur between the hours of 7:00 AM and 6:00 PM. In the event that any night work, extended hours, or Saturday work is expected, the Construction Manager will coordinate the schedule with the City of Boston for approval.

#### **6.11.5 Phases of Construction**

The project will be constructed in one phase.

#### **6.11.6 Construction Staging Area**

The construction logistic plans will be designed to isolate construction activity from the surrounding neighborhood while providing safe access for pedestrians and vehicles during normal day-to-day activities and emergencies.

All construction activities will be kept within areas designated by the CMP. There will be no stockpiling of fill, equipment, or materials on public property or public ways unless identified by the CMP and permitted by all authorities having jurisdiction. Truck idling restrictions will be specified in all subcontracts. “Real-time” management practices will be employed for deliveries. Local streets will not be used for staging delivery trucks. Construction contracts will include provisions restricting truck travel to approved routes. The impact of construction trucks in the evening peak hour is expected to be insignificant because most deliveries are completed prior to the end of the typical construction workday.

#### **6.11.7 Signage and Parking Controls**

During construction, secure fencing and barricades will be used to isolate the construction areas from pedestrian traffic around the site. In addition, sidewalk areas and walkways near construction activities will be well marked to protect pedestrians and ensure their safety. Directional signage will be installed and regularly updated as site conditions change during construction. When required, overhead protection will be used to isolate and safeguard pedestrians along the sidewalk during all phases of construction.

#### **6.11.8 Perimeter Protection/Public Safety**

The perimeter of the Project Site will be driven chain link fencing with scrim. A combination of cones, barrels, and soft barriers will be employed to prevent pedestrians from accidentally entering the construction site. The fencing will be secured at night and during non-working hours.

The Construction Manager or the Proponent’s Project Manager will maintain a log of all contacts including emergencies and complaints, indicating the incident or complaint, date, time, and nature of the incident or complaint, and resolution of the incident or complaint.



An information board will be posted at the construction site and include the following information.

- General Project Summary
- Contact Information for the Construction Team
- Emergency Contact Information
- Contact Number for Complaints

#### **6.11.9 Abutters**

Prior to the commencement of construction, all immediate abutting properties will be contacted to explain the Proposed Project, and to discuss any anticipated impacts due to the planned construction. Potential impacts will be reasonably mitigated throughout the construction period. Immediate abutters will be given updates on progress and expectations for construction activities as the project progresses. At all times during construction activity there will be management staff on-site and available for assistance.

#### **6.11.10 Construction Waste**

This Proposed Project will have a LEED certifiable building which requires the reprocessing and recycling of construction waste. The disposal contract will include specific requirements that will ensure that the dictated requirements are met. All waste material will be transported in covered trucks to an approved solid waste facility, in accordance with MassDEP Regulations for Solid Waste Facilities set forth at 310 CMR 10.00. This requirement will be specified in the disposal contract.

#### **6.11.11 Construction Worker Parking**

The number of workers required during the construction period will vary. Because the construction workers will be arriving and departing during off-peak traffic periods, they are not expected to significantly affect traffic conditions in the project area. No vehicles will be allowed to park on the Project Site or public streets. Stacking of delivery trucks is not allowed and subcontractors will encourage their employees to use public transportation.

#### **6.11.12 Roadway and Sidewalk Closures**

During construction, the sidewalks directly adjacent to the Project Site will be temporarily closed when warranted by specific construction activity but kept to a minimum. During utility

tie-ins, temporary parking bans may be required on adjacent streets in order to maintain a safe environment for workers and the general public.

#### **6.11.13 Off-Site Staging**

At no time will the City streets be used for crane placement and/or off-loading of trucks without a permit application and approval. Any trucks unable to access the loading/queuing area upon arrival shall be directed to off-site areas, not on the public way. Trucks coming to and from the Project Site will be required to use major arterial roadways or highways and not local streets. The selection of proposed truck routes is based on the following criteria:

- Minimizing truck activity in the residential neighborhoods.
- Designating specific roads where trucks are permitted; and
- Providing access to and from the major arteries

#### **6.11.14 Dust Control**

To mitigate dust emissions, the Construction Manager and all site-related contractors will utilize the following measures:

- Wetting agents will be used regularly to control and suppress dust that may come from exposed excavations, chipping, sawing, etc.
- All trucks for transportation of construction debris will be tarped and their wheels will be cleaned (in the event that trucks ever leave an asphalt surface).
- No storage of construction debris will be allowed on site, other than in dumpsters, which will be tarped over during non-working hours.
- Construction practices will be monitored to ensure that unnecessary transfers and mechanical disturbances of loose materials are minimized and that any emissions of dust are negligible.
- Street cleaning shall be provided on a weekly or as required basis during the excavation phase and on an as-needed basis during construction.

#### **6.11.15 Odor Control**

Methods to be used by the Construction Manager to control odor emissions associated with earthwork include:

- Improving site drainage in order to minimize standing water from remaining in excavated areas, and pumping collected groundwater to sump locations.

- Covering stockpiles of excavated material with polyethylene sheeting and securing it with sandbags or an equivalent method to prevent the cover from being displaced by wind.
- Reducing the amount of time that excavated material is exposed to the open atmosphere.
- Maintaining the construction site free of trash, garbage, and debris.

#### **6.11.16 Construction Noise**

Every reasonable effort will be made to minimize the noise impact of construction activities.

Mitigation measures to be undertaken will include:

- Heavy and/or noisy equipment will not be started or utilized prior to 7:00 AM.
- Using appropriate mufflers on all equipment and ongoing maintenance of intake and exhaust mufflers.
- Muffling enclosures on continuously running equipment, such as air compressors and welding generators.
- Using less noise-specific construction operations and techniques where feasible (e.g., mixing concrete off-site instead of on-site).
- Selecting the quietest of options for all equipment and procedures (e.g., electric, instead of diesel-powered equipment, hydraulic instead of pneumatic impact tools).
- Scheduling equipment operations to keep average levels low, synchronize the noisiest operations with times of highest ambient levels, and maintain relatively uniform noise levels.
- Turn off idling equipment.
- Locating noisy equipment as far as possible from sensitive areas.
- If there are noise complaints or issues, the Construction Manager will provide quantitative noise metering, and will use that information to mitigate neighborhood impact to the greatest extent possible.

#### **6.11.17 Other Construction Mitigation**

##### **Vibration**

All means and methods for performing work at the Project Site will be evaluated to minimize potential vibration impacts on the adjacent properties and other nearby buildings. Except as

may occur as part of the demolition of the existing library building, the Proposed Project is not expected to include heavy vibration activities. A pre-construction survey of the surrounding buildings may be completed by a third-party Engineering Company. They will also monitor the Project Site through the duration of construction.

#### **Utilities**

Protection of the City of Boston and the BWSC water, sewer, and drain lines will begin before commencement of the site work. Hand exaction will take place when excavating in the immediate area of pipe walls if required.

The project specifications will require the contractors to give written notice of pending construction that will affect utilities to all public or private service corporations or officials owning or having charge of such utilities.

In addition, the contractors will be required to notify Massachusetts Dig Safe and obtain a dig safe number for each off-site area to be disturbed prior to disturbing the existing ground in any way. The contractor will also be required to locate carefully all subsurface structures before beginning any work or operation that might damage such structure. Finally, the contractor will submit pre-task plan reviewing procedures to assure they will conduct operations so as to avoid damaging any structures. Prior to the start of construction in any phase, the CM will provide the authorities with a description of any off-site utility requirements that require street closings. Connections to existing utility services will be coordinated with the appropriate utility provider as well as the City of Boston.

#### **Snow Removal**

Snow accumulation from the site and sidewalks adjacent to the Project Site will be removed and deposited on private property or trucked off-site and legally disposed.

#### **Cleaning**

Sidewalks and the Project Site will be cleaned as needed to minimize the accumulation of dirt and debris.

Street cleaning will be provided by a mechanical street sweeper on a weekly basis during excavation phase and on an as-needed basis during subsequent construction phases.

#### **6.11.18 Municipal Coordination – Local Authorities**

##### **Boston Police Department (BPD)**

BPD will have access to the Project Site as needed. Police details will be provided during construction activities as required to facilitate traffic flow and pedestrian safety. Construction procedures will be designed to meet all Occupational Safety and Health Administration (OSHA) safety standards for specific site construction activities.

##### **Boston Fire Department (BFD)-**

BFD will also have access to the Project Site as needed. Existing fire hydrants that are to remain will be flagged and clearly marked for BFD use. Access to the site for emergency vehicles will be maintained at all times. The Project Site will be available for inspection by the police and fire departments upon completion of the site preparation and mobilization phase to ensure compliance of all emergency access and safety.

##### **National Fire Protection Association 241**

In accordance with the newly-established National Fire Protection Association (NFPA) 241 requirements, a project-specific NFPA 241 Construction Fire Safety Program will be established for the Proposed Project. Additionally, in accordance with NFPA 241, the Proponent will comply with the requirement to obtain BFD approval of the 241 Program prior to release of the building permit by the Inspectional Services Department.

##### **National Fire Protection Association 4**

The Proponent will perform integrated Fire and Life Safety System Testing for high-rise buildings and buildings with smoke control, in accordance with NFPA 4. Once the testing is completed, the Proponent will also submit the required Testing Report to the AHJ prior to the issuance of COFO and witness of AHJ acceptance testing. The Proponent fully understands that this not only applies to new buildings, but also to existing buildings where:

- New fire protection or life safety systems are installed and integrated into existing fire protection and life safety systems;
- Existing fire protection or life safety systems are modified to become part of an integrated system; or
- Changes are made to site-specific software for an individual system that is a part of an integrated system.



## **7. Historic and Archaeological Resources**

### **7.1 Historic Resources on the Project Site**

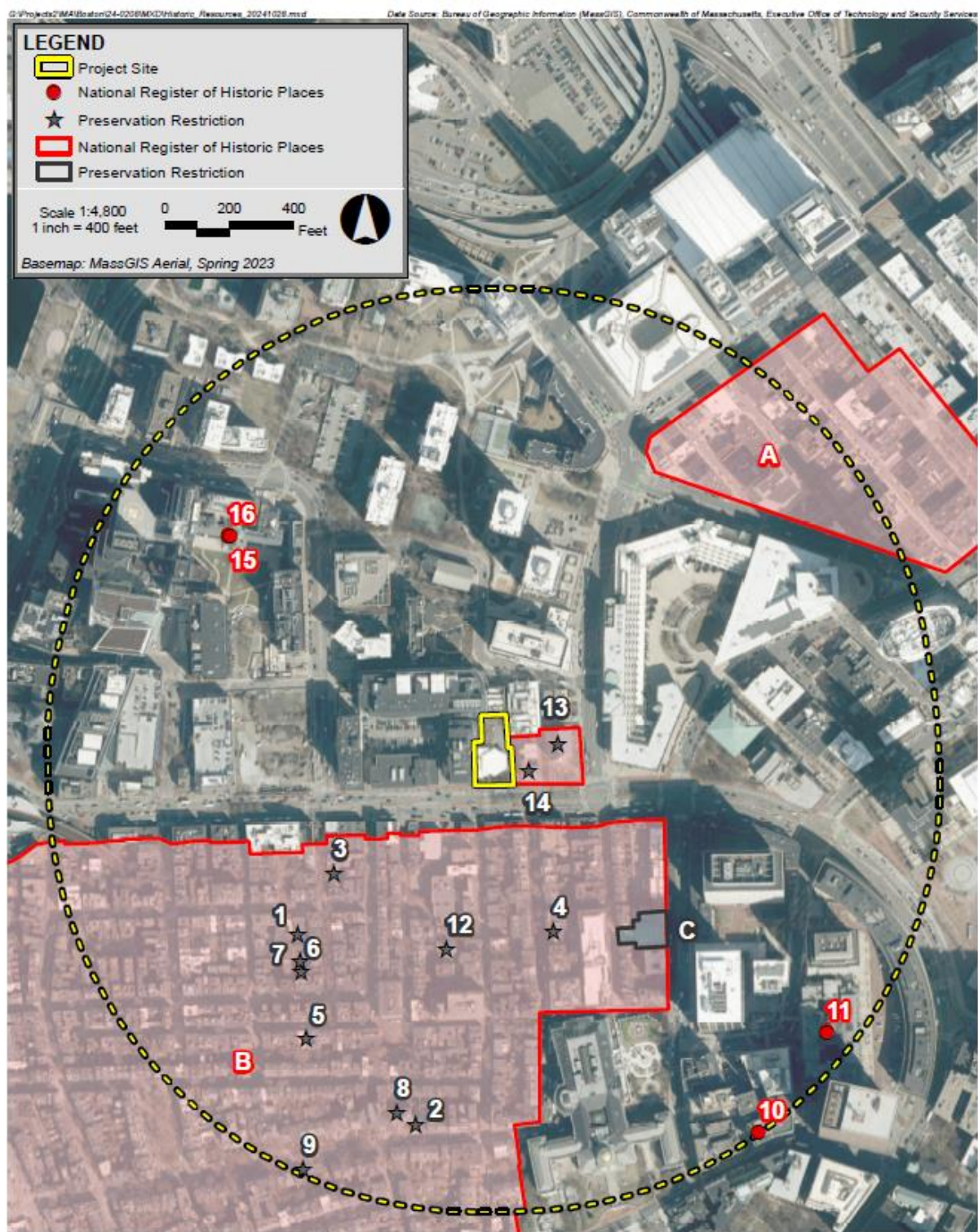
The Project Site consists of an approximately 0.51-acre parcel located at 151 Cambridge in Boston's West End neighborhood. The Project Site is bound by Cambridge Street to the south, the Charles River Plaza to the north and west and the Otis House to the east. The Project Site includes the existing hexagonal shaped one-story West End Branch of the BPL constructed in 1968. The building is included in the Massachusetts Historical Commission's (MHC) Inventory of Historic and Archaeological Assets of the Commonwealth ("the Inventory") but is not listed in the State or National Registers of Historic Places.

Constructed in 1968, the existing library building was designed by the Boston architectural firm Maginnis, Walsh & Kennedy. The library is a hexagonal shaped, one-story building with a flat roof. Each elevation of the building is formed by three bays of blue enamel panels capped by large steel divided light fixed sash windows. Each bay is divided by a narrow blue enamel pier. The flat roof has a large overhang that extends beyond the facade. The recessed parapet set in line with the facade below is clad in corrugated metal panels. A one-story brick flat roof wing extends from the west end of the building to the adjacent building to the north. A single metal divided light fixed sash window with limestone trim is set within the facade of the brick building. The building's main entrance is situated within the southwest corner connecting the hexagonal building and the masonry wing. The entrance features glazed aluminum double doors with side lights and a transom set between glazed aluminum storefront windows with transoms. The entrance bay is sheltered beneath a projecting flat roof supported by two simple columns. The Proposed Project includes the demolition of the existing building on the Project Site.

### **7.2 Historic Resources within the Vicinity of the Project Site**

The Project Site is located in a densely developed urban environment. As is typical of such environments, there are numerous historic resources located within close proximity, including several that are listed in the State and National Register of Historic Places. [Table 7-1](#) lists the State and National Register-listed properties and historic districts located within a quarter-mile radius of the Project Site. [Figure 7-1](#) depicts the locations of these resources.

**Figure 7-1 Historic Resources Map**



151 Cambridge Street Boston, Massachusetts



**Figure 1**  
Historic Resources Map

**Table 7-1 Historic Resources in the Project Vicinity**

Map Key	Historic Resource	Address	Designation
A	Bulfinch Triangle Historic District	Roughly bound by Haverhill Street to the northeast, New Chardon Street to the southeast, Merrimac Street to the southwest and Causeway Street to the northwest	NRDIS
B	Beacon Hill Historic District	Roughly bound by Cambridge Street to the north, Bowdoin Street to the east, Beacon Street to the south and Storrow Drive to the south	NRDIS, NHL
C	Saint John the Evangelist Mission Church and Rectory	Roughly bound by Bowdoin Street to the east, Temple Street to the west between Derne Street and Cambridge Street	NRDIS, NHL, LHD, PR
1	Vilna Shul	14-16 Philips Street	PR, NHL
2	Jonathan-Parker Mason, Charles Harvey House	55 Mount Vernon Street	PR, NHL
3	Samuel H.- Samands, E. Remick House	24 Garden Street	PR, NHL
4	William H. Horton House	30 Hancock Street	PR, NHL
5	Dr. Calvin G. Page Double House	78-80 Myrtle Street	PR, NHL
6	Amos A. Lawrence House	1 Rollins Place	PR, NHL
7	William and Samuel K. Buss House	3 Rollins Place	PR, NHL
8	Adam Wallace-Bigelow Thaxter, Dr. Jacob House	59 Mount Vernon Street	PR, NHL
9	Swan Stable #3	60 Mount Vernon Street	PR, NHL
10	Boston Transit Commission Building	15 Beacon Street	NRIND
11	John Adams Courthouse	1 Pemberton Square	NRIND
12	African Meeting House	8 Smith Court	PR, NRIND, NHL
13	Old West Church	131 Cambridge Street	NRIND, NHL, PR
14	First Harrison Gray Otis House	141 Cambridge Street	NRIND, NHL, MA/HL, PR
15	Massachusetts General Hospital-Bulfinch Building	255-265 Fruit Street	NRIND, NHL
16	Massachusetts General Hospital – Ether Dome	255-265 Fruit Street	NRIND, NHL

**\*Designation Legend**

LHD	Local Historic District
MA/HL	Massachusetts Historic Landmark
NRIND	National Register of Historic Places Individual property
NRDIS	National Register of Historic Places Historic District
NHL	National Historic Landmark
PR	Preservation Restriction

### **7.3 Archaeological Resources on the Project Site**

A review of the MHC's online archaeological base maps conducted on November 7, 2024, revealed no known recorded archaeological sites within the Project Site. Due to previous ground disturbance activities and other improvements, including the construction of the existing building on the Project Site and other activities, it is unlikely that the Project Site contains significant archaeological resources.

### **7.4 Potential Impacts to Historic Resources**

#### **7.4.1 Urban Design**

As noted above, the Proposed Project involves the construction of a 14-story mixed-use building. The lower two levels will include a new library branch while the upper levels will contain approximately 119 income-restricted rental residential units. The building will include community spaces for residents and bike storage below grade. The first-floor library portion of the building will be fully glazed. The upper levels of the building will be slightly recessed from the first-floor façade to minimize the visual impact of the building at the pedestrian level. The upper levels are divided into two sections to minimize the volume of the building, with the massing to the west to minimize the impact to the Harrison Gray Otis House. The upper levels feature brick frames with vertical piers that bring corbelling and bonding patterns. The library's lower levels will be set in line with the existing streetscape. The elevations of the two-story library will feature large window walls to connect the space to the public realm. Open space between the Proposed Project and Otis House will minimize the visual impact of the Proposed Project on the existing streetscape and the Otis House. The vertical elements of the lower level will bring more depth to the lower level.

The building will use brick that is a prominent material throughout the West End and Beacon Hill, linking the Proposed Project to the neighborhood in a contemporary interpretation. Secondary panel elements will be installed on the exterior of the building to evoke wood shutters as seen on many of the historic buildings located throughout the surrounding neighborhoods.

The Proposed Project design is not anticipated to adversely impact nearby significant historic resources. The elimination of existing surface parking areas will improve the setting of nearby historic resources.

#### **7.4.2 Shadow Impacts**

As noted in [Section 6.2](#) of this PNF, shadow impact studies were conducted to demonstrate the anticipated impacts from the Proposed Project. This consisted of standard shadow studies that were conducted for March 21, June 21, September 21, and December 21 at 9:00 a.m., 12:00 p.m., and 3:00 p.m. as well as at 6:00 p.m. during the summer solstice and autumnal equinox.

The shadow analysis for the Proposed Project demonstrates that net new shadow will be limited in extent and duration. New shadow from the Proposed Project on the adjacent Otis House and the nearby Old West Church will be limited to the afternoon during the four time periods studied. No new shadow will be cast onto State or National Register listed historic resources or the Beacon Hill Historic District located on the southern side of Cambridge Street.

The results of these shadow studies are included in [Section 3.2](#) and shown in [Figures 3-36](#) through [Figure 3-47](#) in the [Urban Design](#) chapter of this PNF.

#### **7.4.3 Wind Impacts**

As noted in [Section 6.1](#) of the Wind Analysis chapter of this PNF, pedestrian wind safety and comfort studies demonstrate that wind conditions within the surrounding area at pedestrian level will be comparable to the existing conditions. A limited number of locations are predicted to have higher wind speeds. However, landscaping and other potential solutions are being evaluated as necessary to limit impacts to these areas. The results of these wind studies are included in [Section 6.1](#) of this PNF.

#### **7.4.4 Status of Project Review with Historical Agencies**

##### **7.4.4.1 Boston Landmarks Commission**

The submission of this PNF initiates review of the Proposed Project by the BLC under the City's Article 80B review process. The Proposed Project includes demolition of the existing building located on the Project Site and is subject to BLC's review under Article 85 of the Code. At the appropriate time, the Proponent will file an Article 85 application to initiate the BLC's review of the proposed demolition activities.

##### **7.4.5 Massachusetts Historical Commission Review**

As described in [Section 8.1](#) below, the Proponent intends to file an Environmental Notification Form (ENF) and a proposed Environmental Impact Report (EIR) for the Proposed Project



pursuant to the Massachusetts Environmental Policy Act (MEPA). Therefore, MHC will review the Proposed Project in connection with the MEPA review process.

## **8. Coordination With Other Governmental Agencies**

### **8.1 Massachusetts Environmental Policy Act (MEPA) Review**

The Proposed Project will be subject to MEPA review because it proposes to create more than 100 residential units and will be seeking a 121A designation. The Proponent intends to file the Environmental Notification Form (ENF) and proposed Environmental Impact Report (EIR) concurrently as a “roll-over” filing in January 2025, to ensure that the MEPA review process is conducted on a parallel track with the Article 80B review process.

### **8.2 Massachusetts Historical Commission (MHC)**

As noted above, MHC will review the Proposed Project in connection with MEPA review.

### **8.3 Boston Landmarks Commission**

The Proposed Project will be subject to Article 85 Demolition Delay Review by the BLC.

### **8.4 Architectural Access Board Requirements**

The Proposed Project will comply with the requirements of the Architectural Access Board and the standards of the Americans with Disabilities Act.

### **8.5 Boston Civic Design Commission**

Article 28 of the Code stipulates that projects that exceed 100,000 square feet shall be subject to review by the Boston Civic Design Commission (BCDC). The Proposed Project exceeds 100,000 square feet and therefore will be subject to review by the Boston Civic Design Commission.

### **8.6 Boston Interagency Fair Housing Development Committee**

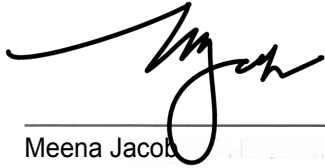
The Proponent has completed the *Affirmatively Furthering Fair Housing Assessment Form*, which is included in [Appendix E](#) of this PNF, and looks forward to engaging with the BIFHDC during the Article 80B review process.

### **8.7 Other Permits and Approvals**


[Section 1.5](#) of this PNF provides a list of key agencies from which pertinent project permits and approvals will be sought.

## 9.0 PROJECT'S CERTIFICATION

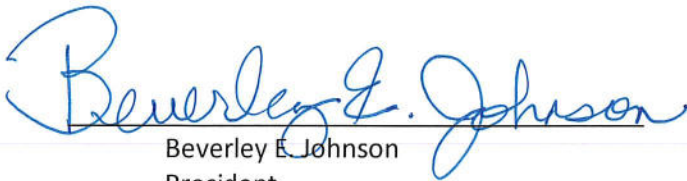
This form has been circulated to the City of Boston Planning Department in accordance with the City of Boston Zoning Code.



Meena Jacob  
Vice President, Real Estate Development  
Preservation of Affordable Housing, Inc.



Patrick A. Kimble  
Founder & Managing Partner  
Caste Capital LLC



Beverley E. Johnson  
President  
Bevco Associates, Inc.  
Preparer

## **Appendix A – Climate and Resiliency Checklist**

# Response Summary

Assigned To	Samira Ahmadi
Target Record	CHA-000117
Status	Completed
Progress	89.22%
Response End Time	2024-12-16T19:56:48.000Z

# Response Detail

Information

Question	Response	Comment
Building Name		
West End Library		
Related Project		
West End Library		
Building Street Number	151	
Building Street Name	Cambridge	
Building Street Suffix	Street	
Select the type of filing	Initial/NPC	
Filing Contact Name		
Samira Ahmadi		
Filing Contact Email		
samira.ahmadi@envien-studio.com		

Team

Enter the names of the companies/organizations on the project team.



Question	Response	Comment
Owner/Developer		
Preservation of Affordable Housing (POAH)		
Architect	MASS Design	
Landscape Architect	G2 Collaborative	
Mechanical Engineer	R.W. Sullivan Engineering	
Sustainability / LEED	enviENERGY Studio	
Performance Modeler	enviENERGY Studio	
Civil Engineer	Nitsch Engineering	
Permitting	Bevco Associates	
Construction Management	TBD	
Transportation Consultant	VHB	
Consultant for Advanced Energy Feasibility Assessment	TBD	

## Building Description and Design Conditions

Question	Response	Comment
Date COBUCS Report was submitted	12/10/2024	
Site Area (SF)	22195	
Length of sidewalk to be reconstructed (LF)	117.00	
What are the building's First Floor Building Uses?	Cultural & Entertainment, Residential - Low Occupant Density	
Please specify the building's below grade uses.	Warehouse & Storage	
Building Gross Square Feet		
176517		

Question	Response	Comment
Project Gross Square Feet		
176517		
Building Gross Floor Area		
176517		
Building Height (Ft)	165	
Building Height (Stories)	14	

## Description and Design Conditions - Building Envelope

When reporting U values, report total assembly U value including supports and structural elements.

**Note:** for any data (number) requests that are not applicable to this project, please enter a value of 0.

Question	Response	Comment
Roof Area (SF)	16000	
Roof U Value	0.020	
Foundation Wall Area (SF)	4985	
Foundation Wall U Value	0.110	
Exposed Floor Area (SF)	515	
Exposed Floor U Value	0.034	
Slab on Grade Area (SF)	7550	
Slab on Grade U Value	0.106	

## Description and Design Conditions - Vertical Above-Grade Assemblies

When reporting U value, report total assembly U value including supports and structural elements.

For any data (number) requests that are not applicable, please enter a value of 0.

Question	Response	Comment
Building Infiltration Rate (AHC @ 50 Pa)	0.06	
Window to Wall Ratio (%)	18%	
Opaque Curtain Wall / Spandrel Area (SF)	0	

Question	Response	Comment
Opaque Curtain Wall / Spandrel U Value	0.000	
Opaque Framed Wall Area (SF)	58915	
Opaque Framed Wall U Value	0.034	
Vision Glazing/Window Type 1 Area (SF)	11685	
Vision Glazing/Window Type 2 Area (SF)	1205	
Vision Glazing/Window Type 1 U Value	0.240	
Vision Glazing/Window Type 2 U Value	0.220	
Vision Glazing/Window Type 1 SHGC	0.35	
Vision Glazing/Window Type 2 SHGC	0.35	
Doors - Area (SF)	156	
Doors - U Value	0.143	
Total Wall Area (SF)	71961	
Vertical U Average	0.070	
Whole Building U Average	0.064	

## Article 37 Green Building

Question	Response	Comment
LEED Certified	No	
LEED Version	v4	
LEED Rating System	New Construction/Major Renovation	
Proposed LEED Rating	Gold	
Proposed LEED point score	62.0	
LEED Zero Certification		

## Building 2035 Predictive Carbon Emissions Intensity (pCEI) Targets and Performance

Using predictive modeling and 2035 Emission Factors, report the modeled performance for Primary, Secondary, and Tertiary Building Uses and the Whole Building including Energy Source Amount(s) and pCEI(s). If multiple uses share common systems or are not individually modeled, use a common pCEI. Otherwise provide use specific performance data.

**Note:** For any data (number) requests that are not applicable, please enter a value of 0.

Question	Response	Comment
2035 Emissions Factor Electric (kg CO2e/MBtu)	52.1	
2035 Emissions Factor Gas (kg CO2e/MBtu)	53.11	

### Building 2035 pCEI Targets and Performance - Primary Use

In the next sections, we ask for information about up to three building uses. Using predictive modeling and 2035 Emission Factors, report the modeled performance for Primary Building Uses including Energy Source Amount(s) and pCEI(s). If multiple uses share common systems or are not individually modeled, use a common pCEI. Otherwise provide use specific performance data.

**Note:** For any data (number) requests that are not applicable, please enter a value of 0.

Question	Response	Comment
Please indicate the building's primary use type	Residential - High Occupant Density	
Square footage of the building's primary use floor area including related uses	157017	
Primary Use Annual Electric (MBtu/yr)	3770.00	
Primary Use Annual Electric pCEI (kg CO2e/sf/yr)	1.25	
Primary Use Annual Gas/Other (MBtu/yr)	0.00	
Primary Use Annual Gas/Other pCEI (kg CO2e/sf-yr)	0.00	
Primary Use Energy Amount Totals (MBtu/yr)	3770.00	
Primary Use pCEI totals (kg CO2e/sf-yr)	1.25	

Question	Response	Comment
Does the building have a secondary use that you would like to record pCEI performance for?	Yes	

## Building 2035 pCEI Targets and Performance - Secondary Use

Using predictive modeling and 2035 Emission Factors, report the modeled performance for Secondary Building Uses including Energy Source Amount(s) and pCEI(s). If multiple uses share common systems or are not individually modeled, use a common pCEI. Otherwise provide use specific performance data. **Note:** For any data (number) requests that are not applicable, please enter a value of 0.

Question	Response	Comment
Please indicate the building's secondary use type	Cultural & Entertainment	
Square footage of the building's secondary use floor area including related uses	19500	
Secondary Use Annual Electric (MBtu/yr)	1233.00	
Secondary Use Annual Electric pCEI (kg CO2e/sf-yr)	3.28	
Secondary Use Annual Gas/Other (Mbtu/yr)	0.00	
Secondary Use Annual Gas/Other pCEI (kg CO2e/sf-yr)	0.00	
Secondary Use Energy Amount Subtotal (MBtus/yr)	1233.00	
Secondary Use pCEI Subtotal (kg CO2e/sf-yr)	3.28	
Does the building have a tertiary use that you would like to record pCEI performance for?	No	

## Building 2035 pCEI Targets and Performance - Whole Building



Using predictive modeling and 2035 Emission Factors, report the modeled performance for Whole Building Uses including Energy Source Amount(s) and pCEI(s). If multiple uses share common systems or are not individually modeled, use a common pCEI. Otherwise provide use specific performance data.

**Note:** for any data / number requests that are not applicable, please enter a value of 0.

Question	Response	Comment
Whole Building pCEI (kg CO2e/sf-yr)		
Total Annual Energy (Mbtu/yr)		
Energy Use Intensity (kBtu/sf-yr)	28.30	
Annual Heating (kBtu/sf-yr)	3.47	
Peak Heating Load (Btu/hr-sf)	3.21	
Annual Cooling (kBtu/sf-yr)	3.54	
Peak Cooling Load (Btu/hr-sf)	2.43	
Energy Code Compliance Path	Passive House	
Energy Use Below Code (%)	0%	

## Building Performance Assistance (Utility, State and Federal)

Question	Response	Comment
Has the project team met with utility representative for project assistance?	No	
Have the local utilities reviewed the predictive performance model?	No	
Will the project receive assistance?	Yes	
How much funding assistance?	0	Project will participate in Mass Save Passive House incentives program which will make the project eligible for up to \$3,000/unit incentives.

## Carbon Emission Mitigation - On-site Renewable Energy Generation

Question	Response	Comment
System 1 - select the type	No	
System 1 Ownership		

Question	Response	Comment
System 1 - indicate it's size in kW	0	
System 1 Annual Output (kWh)	0	
System 2 - select the type	No	
Total Systems (kW)		
Total Annual Output (kWh)		

## Carbon Emission Mitigation - On-site Renewable Energy Storage

Question	Response	Comment
Select the Energy Storage System Type	No	
Describe the ownership		
Storage System Size (kW)		
Storage System Capacity (MBtu)		

## Building Carbon Emission Mitigation – Off-site measures - Procurement Renewable Electricity

Question	Response	Comment
Describe the type of Renewable Electricity procurement	TBD	
Describe the source of renewable electricity		
Annual Quantity of renewable electricity (kWh)		
Renewable electricity procurement - % of total Annual Electricity Usage		

## Building Carbon Emission Mitigation – Off-site measures - Procurement RECs, Power Purchase Agreements, and other Mechanism

Question	Response	Comment
Describe the type of RECs, Power Purchase Agreements, and other Mechanism	TBD	
Source of RECs, Power Purchase Agreements, and other Mechanism		
Annual Quantity of RECs, Power Purchase Agreements, and other Mechanism (tons of CO2e)		
Percent of total Annual Carbon Emissions - RECs, Power Purchase Agreements, and other Mechanism		

### Payments for Non-electricity Carbon Emissions

Question	Response	Comment
Describe the type of non-electricity carbon emissions	None. All-electric building	
Source of non-electricity carbon emissions		
Annual Quantity (tons of CO2e)		
Non-electricity carbon emissions - % of annual carbon emissions		

### Extreme Heat Mitigation - Site (Existing and Proposed)

Annual average temperature in Boston increased by about 2F in the past hundred years and will continue to rise due to climate change. By the end of the century, the average annual temperature could be 56° (compared to 46° now) and the number of days above 90° (currently about 10 a year) could rise to 90.

Note: please enter a value of 0 for any data/number requests that do not apply to your project.

Question	Response	Comment
Existing Hardscape - Percent of Site	30%	
Proposed Hardscape - Percent of Site	27%	
Existing Softscape - Percent of Site	38%	

Question	Response	Comment
Proposed Softscape - Percent of Site	3%	
<p><b>Extreme Heat Mitigation - Urban Heat Island Reduction – Proposed Site and Building</b></p>		
Question	Response	Comment
Non-roof Landscape Area (SF)	6734	
Non-roof Landscape Percent of Site (%)	30%	
Non-roof Landscape - Area Meeting LEED Criteria (SF)	6743	
Non-roof Landscape - SRI Value	0	
Non-roof Hardscape - Area (SF)	6041	
Non-roof Hardscape Percent of Site (%)	27%	
Non-roof Hardscape - Area Meeting LEED Criteria (SF)	6041	
Non-roof Hardscape - SRI Value	28	
Roof Surface Area (SF)	16494	
Roof Surface Percent of Site (%)	74%	
Roof Surface Area Meeting LEED Criteria (SF)	16494	
Roof Surface SRI Value	82	
Roof Vegetated Area (SF)	0	
Roof Vegetated Percent of Site (%)	0%	
Roof Vegetated Area Meeting LEED Criteria (SF)	0	
Roof Vegetated SRI Value	0	
Total Area (SF)	29269	
TOTAL Area Meeting LEED Criteria (SF)	29278	
Total SRI Value (weighted average)	52	

Question	Response	Comment
Vertical Cool Wall Area (SF)	0	
Vertical Cool Wall Area Meeting LEED Criteria (SF)	0	
Vertical Cool Wall - Percent Meeting LEED Criteria	0%	

## Extreme Precipitation Mitigation - Storm Water Management - Site and Building

From 1958 to 2010, there was a 70 percent increase in the amount of precipitation that fell on the days with the heaviest precipitation. Currently, the 10-Year, 24-Hour Design Storm precipitation level is 5.25". There is a significant probability that this will increase to at least 6" by the end of the century. Additionally, fewer, larger storms are likely to be accompanied by more frequent droughts.

Question	Response	Comment
Are any parcels across the entire project located in a Groundwater Conservation Overlay District (GCOD)?	No	
Permeable Site Surfaces - Area (SF)	570	
Permeable Site Surfaces - % of Site	3%	
Impermeable Site Surfaces - Area (SF)	5131	
Impermeable Site Surfaces % of Site (SF)	23%	
Imp. Surfaces Water fr 1" of Rain (CF)	427	
Imp. Surfaces Water fr 1.25" Rain (CF)	534	
Roofs - Area (SF)	16494	
Roofs - Percent of Site (SF)	74%	
Roofs - Water from 1" of Rain (CF)	1374	
Roofs - Water from 1.25" of Rain (CF)	1718	
Total Area Precipitation Mitigation (SF)	22195	
TOTAL - Water from 1" of Rain (CF)	1801	
TOTAL - Water from 1.25" of Rain (CF)	2252	
Rain Water Reuse - Type	NA	



Question	Response	Comment
Rain Water Reuse - Amount (CF)	0	
Storm Water Reuse - Type	NA	
Storm Water Reuse - Amount (CF)	0	
Green Infrastructure - Type	NA	
Green Infrastructure - Amount (CF)	0	
Storm Water Retention - Type	Subsurface retention	
Storm Water Retention - Amount (CF)	2252	
TOTAL Retention - Amount (CF)	2252	

## Sea Level Rise and Storms

Under any plausible greenhouse gas emissions scenario, sea levels in Boston will continue to rise throughout the century. This will increase the number of buildings in Boston susceptible to coastal flooding and the likely frequency of flooding for those already in the floodplain.

Question	Response	Comment
Is any portion of the site in a FEMA SFHA zone?	No	
Is any portion of the site in the BPDA Coastal Flood Resilience Overlay District? Use the online <a href="http://maps.bostonredevelopmentauthority.org/zoningviewer/">BPDA Zoning Viewer</a> ( <a href="http://maps.bostonredevelopmentauthority.org/zoningviewer/">http://maps.bostonredevelopmentauthority.org/zoningviewer/</a> ) to assess the susceptibility of the project site.	No	

## **Appendix B – Accessibility Checklists**

## **ARTICLE 80 – ACCESSIBILITY CHECKLIST**

### **A Requirement of the Boston Planning & Development Agency (BPDA) Article 80 Development Review Process**

The Mayor's Commission for Persons with Disabilities works to reduce architectural barriers that impact accessibility in Boston's built environment. This Checklist is intended to ensure that accessibility is planned at the beginning of projects, rather than after a design is completed. It aims to ensure that projects not only meet minimum MAAB/ADA requirements, but that they create a built environment which provides equitable experiences for all people, regardless of age or ability.

All BPDA Small or Large Project Review, including Institutional Master Plan modifications, must complete this Checklist to provide specific detail and data on accessibility. An updated Checklist is required if any project plans change significantly.

For more information on compliance requirements, best practices, and creating ideal designs for accessibility throughout Boston's built environment, proponents are strongly encouraged to meet with Disability Commission staff prior to filing.

#### **Accessibility Analysis Information Sources:**

1. Age-Friendly Design Guidelines – Design features that allow residents to Age in Place  
<https://www.enterprisecommunity.org/download?fid=6623&nid=3496>
2. Americans with Disabilities Act – 2010 ADA Standards for Accessible Design  
[http://www.ada.gov/2010ADASTandards\\_index.htm](http://www.ada.gov/2010ADASTandards_index.htm)
3. Massachusetts Architectural Access Board 521 CMR  
<http://www.mass.gov/eopss/consumer-prot-and-bus-lic/license-type/aab/aab-rules-and-regulations-pdf.html>
4. Massachusetts State Building Code 780 CMR  
<http://www.mass.gov/eopss/consumer-prot-and-bus-lic/license-type/csl/building-codebbrs.html>
5. Massachusetts Office of Disability – Disabled Parking Regulations  
<http://www.mass.gov/anf/docs/mod/hp-parking-regulations-summary-mod.pdf>
6. MBTA Fixed Route Accessible Transit Stations  
[http://www.mbta.com/riding\\_the\\_t/accessible\\_services/](http://www.mbta.com/riding_the_t/accessible_services/)
7. City of Boston – Complete Street Guidelines  
<http://bostoncompletestreets.org/>
8. City of Boston – Mayor's Commission for Persons with Disabilities  
<http://www.boston.gov/disability>
9. City of Boston – Public Works Sidewalk Reconstruction Policy  
[http://www.cityofboston.gov/images\\_documents/sidewalk%20policy%200114\\_tcm3-41668.pdf](http://www.cityofboston.gov/images_documents/sidewalk%20policy%200114_tcm3-41668.pdf)
10. City of Boston – Public Improvement Commission Sidewalk Café Policy  
[http://www.cityofboston.gov/images\\_documents/Sidewalk\\_cafes\\_tcm3-1845.pdf](http://www.cityofboston.gov/images_documents/Sidewalk_cafes_tcm3-1845.pdf)
11. International Symbol of Accessibility (ISA)  
<https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/guide-to-the-ada-standards/guidance-on-the-isa>
12. LEED – Pilot Credits for Social Equity and Inclusion  
<https://www.usgbc.org/articles/social-equity-pilot-credits-added-leed-nd-and-leed-om>

#### **Glossary of Terms:**

1. **Accessible Route** – A continuous and unobstructed path of travel that meets or exceeds the dimensional requirements set forth by MAAB 521 CMR: Section 20
2. **Accessible Guestrooms** – Guestrooms with additional floor space, that meet or exceed the dimensional requirements set forth by MAAB 521 CMR: Section 8.4
3. **Age-Friendly** – Implementing structures, settings and policies that allow people to age with dignity and respect in their homes and communities
4. **Housing – Group 1 Units** – Residential Units that contain features which can be modified without structural change to meet the specific functional needs of an occupant with a disability, per MAAB 521 CMR: Section 9.3
5. **Housing – Group 2 Units** – Residential units with additional floor space that meet or exceed the dimensional and inclusionary requirements set forth by MAAB 521 CMR: Section 9.4
6. **Ideal Design for Accessibility** – Design which meets, as well as exceeds, compliance with AAB/ADA building code requirements
7. **Inclusionary Development Policy (IDP)** – Program run by the BPDA that preserves access to affordable housing opportunities in the City. For more information visit: <http://www.bostonplans.org/housing/overview>
8. **Public Improvement Commission (PIC)** – The regulatory body in charge of managing the public right of way in Boston. For more information visit: <https://www.boston.gov/pic>
9. **Social Equity LEED Credit** – Pilot LEED credit for projects that engage neighborhood residents and provide community benefits, particularly for persons with disabilities

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10. **Visitability** – A structure that is designed intentionally with no architectural barriers in its common spaces (entrances, doors openings, hallways, bathrooms), thereby allowing persons with disabilities who have functional limitations to visit

<b>Today's Date:</b> 12.13.2024		<b>Your Name and Title:</b> Megan Altendorf, AIA, NCARB Design Director at MASS Design Group	
<b>1. Project Information:</b> <i>If this is a multi-phased or multi-building project, fill out a separate Checklist for each phase/building.</i>			
Project Name:		West End Library Development	
Project Address(es):		151 Cambridge Street, Boston	
Total Number of Phases/Buildings:		1 building, 1 phase	
Primary Contact: (Name / Title / Company / Email / Phone):		Kristel Salinas, Project Manager, Preservation of Affordable Housing, ksalinas@poah.org, 361.676.1446	
Owner / Developer:		Preservation of Affordable Housing	
Architect:		MASS Design Group/ The Architectural Team	
Civil Engineer:		Nitsch Engineering	
Landscape Architect:		G2	
Code Consultant:		Code Red	
Accessibility Consultant (If you have one):		Code Red	
What stage is the project on the date this checklist is being filled out?	SPRA / PNF / Expanded PNF Submitted	Draft / Final Project Impact Report Submitted	BPDA Board Approved or other: _____
<b>2. Building Classification and Description:</b> <i>This section identifies preliminary construction information about the project including size and uses.</i>			
What are the dimensions of the project? See below:			
Site Area:	22,195 SF	Building Area:	176,517 GSF
First Floor Elevation:	+30/31/32'	Any below-grade space	Yes
What is the construction classification?	<u>New Construction</u>	Renovation	Addition Change of Use
Do you anticipate filing any variances with the MAAB (Massachusetts Architectural Access Board) due to non-compliance with 521 CMR?	NO		
If yes, is the reason for your MAAB variance: (1) technical infeasibility, OR (2) excessive and unreasonable cost without	(1) OR (2) N/A		

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substantial benefit for persons with disabilities? Have you met with an accessibility consultant or Disability Commission to try to achieve compliance rather than applying for a variance? Explain:				
What are principal building uses? (using IBC definitions, select all appropriate that apply):	Residential – One - Three Unit	<b><u>Residential - Multi-unit, Four+</u></b>	Institutional	Educational
	Business	Mercantile	Factory	Hospitality
	Laboratory / Medical	Storage, Utility and Other	Other:	<b><u>A-3, Library</u></b>
List street-level uses of the building:	Library, Residential Lobby, Back of House			
<b>3. Accessibility of Existing Infrastructure:</b> <i>This section explores the proximity to accessible transit lines and institutions. Identify how the area surrounding the development is accessible for people with mobility impairments, and analyze the existing condition of the accessible routes to these sites through sidewalk and pedestrian ramp reports.</i>				
Provide a description of the neighborhood where this development is located and its identifying topographical characteristics:	The project is located in the West End neighborhood on the north side of Cambridge Street between Staniford and Blossom Streets. The area is relatively flat, with a gradual incline west down to the Charles river on Cambridge street. The northern half of the neighborhood contains a generous tree canopy in comparison to other more densely built neighborhoods of the city, however the southern half and Mass General Hospital area contains fewer trees, primarily located on streets. Mature trees exist on the project site and on the Cambridge street sidewalk.			
List the surrounding accessible MBTA transit lines and their proximity to development site, including commuter rail, subway stations, and bus stops:	Accessible Commuter / subway stations: Charles/MGH (0.3 mile), Government Center (0.3 mile), Park Street (0.4 mile), Haymarket (0.4 mile), North Station (0.5 mile) Accessible Bus Stops: Beacon & Park Street: 43 (0.4 mile), Haymarket: 4, 92, 93, 111, 426, 428, 450 (0.4 mile), North Station: 4, EZ (0.5 mile)			
List surrounding institutions and their proximity: hospitals, public housing, elderly and disabled housing, educational facilities, others:	Mass General Hospital (Abutting), Beacon Hill Village (0.1 mile), Blackstone Apartments (0.2 mile), Shriners Children's Hospital (0.2 mile)			
List surrounding government buildings and their proximity: libraries, community centers,	West End Branch BPL (co-located), Department of Mental Health (0.2 mile), Eliot K-8 Innovation Upper School (0.6 mile)			



recreational facilities, and related facilities:	
<b>4. Surrounding Site Conditions – Existing:</b> <i>This section identifies current condition of the sidewalks and pedestrian ramps at the development site.</i>	
Is the development site within a formally recognized historic district? <b>If yes</b> , which one?	<b>NO</b>
Are there existing sidewalks and pedestrian ramps at the development site? <b>If yes</b> , list the existing sidewalk and pedestrian ramp slopes, dimensions, materials, and physical condition:	<b>YES</b> <p>The slope of the existing Cambridge Street sidewalk immediately adjacent to the project site ranges from ~4% – 5.7% slope. There is a pedestrian curb ramp in the sidewalk right of way with a detectable warning strip centered on the existing crosswalk. There is also an existing a ramp on the library parcel with a slope of 1:12 leading from the sidewalk to library entry doors. The ramp and sidewalk on the library parcel are concrete measuring 6 feet and 9 feet wide, respectively. The Cambridge Street sidewalk material is currently constructed of brick pavers, measuring ~19.5 feet at its widest point and ~6.5 feet at its narrowest point. The concrete sidewalks and ramp are in fair condition.</p>
Are the sidewalks and pedestrian ramps existing-to-remain? <b>If yes</b> , have they been verified as ADA/MAAB compliant (with yellow composite detectable warnings, cast in concrete)? <b>If yes</b> , provide description and photos. <b>If no</b> , explain plans for compliance:	<b>NO</b> <p>The existing pedestrian ramp at the current crosswalk is proposed to remain. It will be reconstructed to cast the yellow composite detectable warning strip into concrete per the City Standards. The current slopes along the Cambridge Street sidewalk exceed 5%. The proponent will endeavor to create an accessible path of travel at less than 5%. All proposed pedestrian routes to building entries will fully comply with MAAB and ADA requirements maintaining a slope of 2% or less. The brick sidewalk pavers will be replaced with an 8-foot wide concrete sidewalk as the site is not located within a designated historic district. The pavers proposed for the library entry plaza and residential entry sidewalk on site are proposed to be concrete unit pavers which will have square, non-beveled edges with butt-tight joints for ease of access for wheelchairs.</p>
<b>5. Surrounding Site Conditions – Proposed</b> <i>This section identifies the proposed condition of the sidewalks and pedestrian ramps around the development site. Ideal sidewalk width contributes to lively pedestrian activity, allowing people to walk side by side and pass each other comfortably walking alone, in pairs, or using a wheelchair or walker.</i>	
Are the proposed sidewalks consistent with Boston Complete Streets? <b>If yes</b> , choose which Street Type was applied: Downtown Commercial, Downtown Mixed-use, Neighborhood Main, Connector, Residential, Industrial, Shared	<b>YES</b> <p>Downtown Mixed-use</p>

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Street, Parkway, or Boulevard. Explain:	
What are the total dimensions and slopes of the proposed sidewalks? List the widths of each proposed zone: Frontage, Pedestrian and Furnishing Zone:	<b>Frontage:</b> 17' 3" <b>Pedestrian:</b> 8' <b>Furnishing:</b> ranges 1' 9" to 6'
List the proposed materials for each Zone. Will the proposed materials be on private property or will the proposed materials be on the City of Boston pedestrian right-of-way?	<b>Frontage:</b> Unit pavers and concrete <b>Pedestrian:</b> Concrete <b>Furnishing:</b> Brick
Will sidewalk cafes or other furnishings be programmed for the pedestrian right-of-way? <b>If yes</b> , what are the proposed dimensions of the sidewalk café or furnishings and what will the remaining right-of-way clearance be?	NO
If the pedestrian right-of-way is on private property, will the proponent seek a pedestrian easement with the Public Improvement Commission (PIC)?	NO
Will any portion of this project be going through the Public Improvement Commission (PIC)? <b>If yes</b> , identify PIC actions and provide details:	<b>YES</b> The proponent will develop a specific repairs plan for the PIC.
<b>6. Building Entrances, Vertical Connections, Accessible Routes, and Common Areas:</b> <i>The primary objective in ideal accessible design is to build smooth, level, continuous routes and vertical connections that are integrated with standard routes, not relocated to alternate areas. This creates universal access to all entrances and spaces, and creates equity for persons of all ages and abilities by allowing for “aging in place” and “visitability” (visiting neighbors).</i>	
Are all of the building entrances accessible? Describe the	<b>YES</b> Yes, all building entries will maintain a flush condition for accessibility.

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accessibility of each building entrance: flush condition, stairs, ramp, lift, elevator, or other. If all of the building entrances are <b>not accessible</b> , explain:	
Are all building entrances well-marked with signage, lighting, and protection from weather?	<b>YES</b>
Are all vertical connections located within the site (interior and exterior) integrated and accessible? Describe each vertical connection (interior and exterior): stairs, ramp, lift, elevator, or other. If all the vertical connections are <b>not integrated and accessible</b> , explain:	<b>YES</b>
Are all common spaces in the development located on an accessible route? Describe:	<b>YES</b>
Are all of the common spaces accessible for persons with mobility impairments? (Examples: community rooms, laundry areas, outdoor spaces, garages, decks/roof decks):	<b>YES</b>
What built-in features are provided in common public spaces? (Examples: built-in furnishings such as tables, seating; countertop heights, outdoor grills and benches). Are these accessible? Do benches and seats have armrests? Describe:	All common space casework, kitchens, and built-in furnishings will be accessible and meet applicable MAAB and ADA Standards. Benches and seats will have armrests. Multi-generational site furnishings, such as chairs with backs and armrests, playful seating for children, and tiered amphitheater seating, will be provided.
<b>If this project is subject to Large Project Review/Institutional Master Plan</b> , describe the accessible routes way-finding / signage package:	The project is subject to Larger Project Review. Wayfinding and signage will be developed as the design progresses.
<b>7. Accessible Housing Units (If applicable) – Residential Group 1, Group 2, and Hospitality Guestrooms</b>	

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<p><i>In order to create accessible housing and hospitality rooms, this section addresses the number of accessible units that are proposed for barrier-free housing and hotel rooms in this development.</i></p>	
<p>What is the total number of proposed housing units or hotel rooms for this development?</p>	<p>119</p>
<p><b>If a residential development</b>, how many units are for sale? How many are for rent? What is the breakdown of market value units vs. IDP (Inclusionary Development Policy) units?</p>	<p>100% of units will be affordable rental units. IDP is not applicable.</p>
<p><b>If a residential development</b>, will all units be constructed as MAAB Group 1* units, which have blocking and other built-in infrastructure that makes them adaptable for access modifications in the future? (*this is required in all new construction):</p>	<p>YES</p>
<p><b>If a residential development</b>, how many fully built-out ADA (MAAB Group 2) units will there be? (requirement is 5%):</p>	<p>12</p>
<p><b>If a residential development</b>, how many units will be built-out as ADA/MAAB sensory units? (requirement is 2%):</p>	<p>4</p>
<p><b>If a residential development</b>, how many of the fully built-out ADA (MAAB Group 2) units will also be IDP units? <b>If none</b>, explain:</p>	<p>N/A</p>
<p><b>If a hospitality development</b>, how many of the accessible units will feature a wheel-in shower? Will accessibility features and equipment be built in or provided (built-in bench, tub seat, etc.)? <b>If yes</b>, provide details and location of equipment:</p>	<p>N/A</p>

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Do the proposed housing and hotel units that are standard, non-ADA units (MAAB Group 1) have any architectural barriers that would prevent entry or use of the space by persons with mobility impairments? (Example: stairs or thresholds within units, step up to balcony, etc.). <b>If yes</b> , explain:	<b>NO</b>
<b>8. Accessible Parking:</b> <i>See Massachusetts Architectural Access Board Rules and Regulations 521 CMR Section 23.00 regarding accessible parking requirements and the Massachusetts Office of Disability Disabled Parking Regulations.</i>	
What is the total number of parking spaces provided at the development site? Will these be in a parking lot or garage? Will they be mechanically stacked? Explain:	0
How many of these parking spaces will be designated as Accessible Parking Spaces? How many will be “Van Accessible” spaces with an 8 foot access aisle? Describe:	N/A
Will visitor parking be provided? If <b>yes</b> , where will the accessible visitor parking be located?	<b>NO</b>
Has a drop-off area been identified? <b>If yes</b> , where is it located, and is it wheelchair accessible?	<b>YES</b> The loading zone is on-street, adjacent to the curb, and will be designed to comply with City of Boston standards. Currently, this is the location of two City of Boston HC spaces and the configuration of the current curb ramp is not proposed to change.
<b>9. Community Impact:</b> <i>Accessibility and inclusion extend past required compliance with building codes to providing an overall development that allows full and equal participation of persons with disabilities and older adults.</i>	
Has the proponent looked into either of the two new LEED Credit Pilots for (1) Inclusion, or (2) Social Equity – with a proposal that could	<b>YES</b> The proponent will evaluate the feasibility of achieving the Social Equity pilot credit under the LEED Innovation category.

increase inclusion of persons with disabilities? <b>If yes</b> , describe:	
These new LEED Pilot Credits may be awarded for filling out this checklist and evaluating ways to add features to your design that will increase equity for persons with disabilities. Have you looked at this list to assess the feasibility of adding any of these features?	<p style="text-align: center;"><b>NO</b></p> <p>Not to date, but the proponent will evaluate the feasibility of adding these features.</p>
Is this project providing funding or improvements to the surrounding neighborhood or to adjacent MBTA Station infrastructure? (Examples: adding street trees, building or refurbishing parks, adding an additional MBTA elevator or funding other accessibility improvements or other community initiatives)? <b>If yes</b> , describe:	<p style="text-align: center;"><b>YES</b></p> <ul style="list-style-type: none"> <li>• Parks/Open Space: <ul style="list-style-type: none"> <li>○ The open and shared space between the West End Library and our abutter, the Otis House, will serve as a valuable new neighborhood amenity that will help strengthen connections to nearby cultural resources and increase the library's visibility, highlighting its role as a public asset that was once hidden.</li> </ul> </li> <li>• Environmental Improvements: <ul style="list-style-type: none"> <li>○ The West End Library Project will incorporate innovative construction methods aimed at minimizing its environmental impact during both the construction and operational phases. The project will utilize low-carbon construction techniques, including a hybrid steel and Cross Laminated Timber (CLT) approach, and will feature a residential design that meets Passive House standards. Additionally, the building will be equipped with all-electric heating and cooling systems, along with high-efficiency appliances, fixtures, and lighting.</li> </ul> </li> <li>• Community Initiatives: <ul style="list-style-type: none"> <li>○ The project's design and resident services will foster connections among residents, community groups, and local resources in the West End. As the long-term owner of the project, we will leverage our property management and community impact teams to deliver exceptional management, resident services, and community support. These programs will include career development, financial coaching, and other initiatives aimed at building strong relationships in the West End community, helping residents build wealth and achieve financial independence. The library will create a welcoming space where residents, visitors, and local organizations can gather, socialize, and participate in various activities.</li> </ul> </li> <li>• Public Realm Improvements: <ul style="list-style-type: none"> <li>○ The developers are committed to providing contract opportunities for Minority and Women-Owned Business Enterprises (M/WBEs) during the pre-construction and construction phases of the project to achieve the goals of the City of Boston for a diverse construction workforce. In addition, POAH Communities plans to employ three full-time staff members on-site, including a property manager, maintenance superintendent, and a Community Impact Coordinator (CIC) to oversee resident services. The project will also generate local employment opportunities through janitorial, security, and landscaping contracts.</li> </ul> </li> </ul>
Will any public transportation infrastructure be affected by this development, during and/or post-	<p style="text-align: center;"><b>NO</b></p>



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construction (Examples: are any bus stops being removed or relocated)? <b>If yes</b> , has the proponent coordinated with the MBTA for mitigation? Explain:	
During construction, will any on-street accessible parking spaces be impacted (during and/or post-construction)? <b>If yes</b> , what is the plan for relocating the spaces?	<b>YES</b> Two on-street accessible parking stalls on Cambridge Street will be relocated. The Proponent will work with the City to identify nearby locations where these stalls can be relocated.
Has the proponent reviewed these plans with the City of Boston Disability Commission Architectural Access staff? <b>If no</b> , will you be setting up a meeting before filing?	<b>NO</b> No. The Proponent intends to meet with the City of Boston Disability Commission Architectural Access staff post-filing
<b>10. Attachments</b> <i>Include a list of all documents you are submitting with this Checklist – drawings, diagrams, photos, or any other materials that describe the accessible and inclusive elements of this project.</i>	
Provide a diagram of the accessible routes to and from the accessible parking lot/garage and drop-off areas to the development entry locations, including route distances.	
Provide a diagram of the accessible route connections through the site, including distances.	
Provide a diagram the accessible route to any roof decks or outdoor space (if applicable).	
Provide a plan and diagram of the accessible Group 2 units, including locations and route from accessible entry.	
Provide any additional drawings, diagrams, photos, or any other material that describes the inclusive and accessible elements of this project. <ul style="list-style-type: none"> <li>Refer to figures 1-48 – 1-62 for accessibility diagrams. No additional diagrams, photos, or drawings have been provided.</li> </ul>	

This completes the Article 80 Accessibility Checklist required for your project. Prior to and during the review process, Commission staff are able to provide technical assistance and design review, in order to ensure that all buildings, sidewalks, parks, and open spaces are welcoming and usable to Boston's diverse residents and visitors, including those with physical, sensory, and other disabilities.

For questions about this checklist, or for more information on best practices for improving accessibility and inclusion, visit [www.boston.gov/disability](http://www.boston.gov/disability), or contact our Architectural Access staff at:

[ADA@boston.gov](mailto:ADA@boston.gov) | [patricia.mendez@boston.gov](mailto:patricia.mendez@boston.gov) | [sarah.leung@boston.gov](mailto:sarah.leung@boston.gov) |  
617-635-3682 (phone) | 617-635-2726 (fax) | 617-635-2541 (tty)

The Mayor's Commission for Persons with Disabilities  
Boston City Hall, One City Hall Square, Room 967, Boston MA 02201

## **Appendix C – Smart Utilities Checklists**



# Boston Smart Utilities Checklist

Date Submitted:

01/07/2025

Submitted by:

ksalinas@poah.org

## **Background**

The Smart Utilities Checklist will facilitate the Boston Smart Utilities Steering Committee's review of:

- a) compliance with the Smart Utilities Policy for Article 80 Development Review, which calls for the integration of five (5) Smart Utility Technologies (SUTs) into Article 80 developments
- b) integration of the Smart Utility Standards

More information about the Boston Smart Utilities Vision project, including the Smart Utilities Policy and Smart Utility Standards, is available at:

[www.bostonplans.org/smart-utilities](http://www.bostonplans.org/smart-utilities)

Note: Any documents submitted via email to [travis.anderson@boston.gov](mailto:travis.anderson@boston.gov) will not be attached to the pdf form generated after submission, but are available upon request.

## **Part 1 - General Project Information**

1.1 Project Name

West End Library

1.2 Project Address

151 Cambridge Street, Boston, MA 02114

1.3 Building Size (square feet)

176517

*\*For a multi-building development, enter total development size (square feet)*

1.4 Filing Stage

Initial Filing (i.e., PNF)

1.5 Filing Contact Information

1.5a Name

Kristel Salinas



# Boston Smart Utilities Checklist

1.5b Company	Preservation of Affordable Housing
1.5c E-mail	ksalinas@poah.org
1.5d Phone Number	6174490876

## 1.6 Project Team

1.6a Project Owner/Developer	Preservation of Affordable Housing, Caste Capital
1.6b Architect	MASS Design Group, The Architectural Team
1.6c Permitting	Bevco Associates
1.6d Construction Management	Consigli Construction Co.

## Part 2 - District Energy Microgrids

Fill out this section if the proposed project's total development size is equal to or greater than 1.5 million square feet.

Note on submission requirements timeline:

Feasibility Assessment Part A should be submitted with PNF or any other initial filing.

Feasibility Assessment Part B should be submitted with any major filing during the Development Review stage (i.e., DPIR)

District Energy Microgrid Master Plan Part A should be submitted before submission of the Draft Board Memorandum by the BPDA Project Manager (Note: Draft Board Memorandums are due one month ahead of the BPDA Board meetings)

District Energy Microgrid Master Plan Part B should be submitted before applying for a Building Permit

Please email submission to [travis.anderson@boston.gov](mailto:travis.anderson@boston.gov)

<b>2.1 Consultant Assessing/Designing District Energy Microgrid (if applicable)</b>	N/A
---	-----

<b>2.2 Latest document submitted</b>	N/A
--------------------------------------	-----

# Boston Smart Utilities Checklist

**2.3 Date of latest submission**

**2.4 Which of the following have you had engagement/review meetings with regarding District Energy Microgrids? (select all that apply)**

N/A

**2.5 What engagement meetings have you had with utilities and/or other agencies (i.e., MA DOER, MassCEC) regarding District Energy Microgrids? (Optional: include dates)**

N/A

**2.6 Additional Information**

N/A - the proposed project's total development size is not equal to or greater than 1.5 million square feet.

## **Part 3 - Telecommunications Utilidor**

Fill out this section if the proposed project's total development size is equal to or greater than 1.5 million square feet OR if the project will include the construction of roadways equal to or greater than 0.5 miles in length.

Please submit a map/diagram highlighting the sections of the roads on the development area where a Telecom Utilidor will be installed, including access points to the Telecom Utilidor (i.e., manholes)

Please email submission to [travis.anderson@boston.gov](mailto:travis.anderson@boston.gov)

**3.1 Consultant Assessing/Designing Telecom Utilidor (if applicable)**

N/A

**3.2 Date Telecom Utilidor Map/Diagram was submitted**

**3.3 Dimensions of Telecom Utilidor (include units)**

# Boston Smart Utilities Checklist

3.3a Cross-section (i.e., diameter, width X height)

N/A

3.3b Length

N/A

**3.4 Capacity of Telecom Utilidor (i.e., number of interducts, 2 inch (ID) pipes, etc.)**

N/A

**3.5 Which of the following have you had engagement/review meetings with regarding the Telecom Utilidor? (select all that apply)**

N/A

**3.6 What engagement meetings have you had with utilities and/or other agencies (i.e., State agencies) regarding the Telecom Utilidor? (Optional: include dates)**

N/A

N/A - the proposed project's total development size is not equal to or greater than 1.5 million square feet and the project scope does not include the construction of roadways equal to or greater than 0.5 miles in length.

**3.7 Additional Information**

## **Part 4 - Green Infrastructure**

Fill out this section if the proposed project's total development size is equal to or greater than 100,000 square feet.

Please submit a map/diagram highlighting where on the development Green Infrastructure will be installed.

Please email submission to [travis.anderson@boston.gov](mailto:travis.anderson@boston.gov)

**4.1 Consultant Assessing/Designing Green Infrastructure (if applicable)**

Nitsch Engineering



# Boston Smart Utilities Checklist

**4.2 Date Green Infrastructure  
Map/Diagram was submitted**

01/07/2025

**4.3 Types of Green Infrastructure included  
in the project (select all that apply)**

Subsurface infiltration system to retain, on site, a volume of runoff equal to 1.25 inches of rainfall across the portion of impervious area on site.

**4.4 Total impervious area of the  
development (in square inches)**

3196512

**4.5 Volume of stormwater that will be  
retained (in cubic inches)\***

3995640

*\*Note: Should equal to at least "Total  
impervious area (entered in section 4.4)" times  
"1.25 inches"*

**4.6 Which of the following have you had  
engagement/review meetings with  
regarding Green Infrastructure? (select all  
that apply)**

None at this time.

**4.7 What engagement meetings have you  
had with utilities and/or other agencies  
(i.e., State agencies) regarding Green  
Infrastructure? (Optional: include dates)**

None at this time.

**4.8 Additional Information**

N/A

## **Part 5 - Adaptive Signal Technology (AST)**

Fill out this section if as part of your project BTDA will require you to install new traffic signals or make significant improvements to the existing signal system.

Please submit a map/diagram highlighting the context of AST around the proposed development area, as well as any areas within the development where new traffic signals will be installed or where significant improvements to traffic signals will be made.

# Boston Smart Utilities Checklist

Please email submission to [travis.anderson@boston.gov](mailto:travis.anderson@boston.gov)

**5.1 Consultant Assessing/Designing  
Adaptive Signal Technology (if applicable)**

N/A

**5.2 Date AST Map/Diagram was submitted**

**5.3 Describe how the AST system will  
benefit/impact the following  
transportation modes**

5.3a Pedestrians

N/A

5.3b Bicycles

N/A

5.3c Buses and other Public  
Transportation

N/A

5.3d Other Motorized Vehicles

N/A

**5.4 Describe the components of the AST  
system (including system design and  
components)**

N/A

**5.5 Which of the following have you had  
engagement/review meetings with  
regarding AST? (select all that apply)**

N/A

**5.6 What engagement meetings have you  
had with utilities and/or other agencies  
(i.e., State agencies) regarding AST?  
(Optional: include dates)**

N/A

**5.7 Additional Information**

N/A

## **Part 6 - Smart Street Lights**

Fill out this section if as part of your project PWD and PIC will require you to install new street lights or make significant improvements to the existing street light system.



# Boston Smart Utilities Checklist

Please submit a map/diagram highlighting where new street lights will be installed or where improvements to street lights will be made.

Please email submission to [travis.anderson@boston.gov](mailto:travis.anderson@boston.gov)

## 6.1 Consultant Assessing/Designing Smart Street Lights (if applicable)

Nitsch Engineering

## 6.2 Date Smart Street Lights Map/Diagram was submitted

01/07/2025

## 6.3 Which of the following have you had engagement/review meetings with regarding Smart Street Lights? (select all that apply)

N/A - will require PIC review during design.

## 6.4 What engagement meetings have you had with utilities and/or other agencies (i.e., State agencies) regarding Smart Street Lights? (Optional: include dates)

N/A - Will require PIC review during design.

If required, Smart Street Lights infrastructure will be coordinated with Boston Street Lighting during the PIC process.

## 6.5 Additional Information

## Part 7 - Smart Utility Standards

The Smart Utility Standards set forth guidelines for planning and integration of SUTs with existing utility infrastructure in existing or new streets, including cross-section, lateral, and intersection diagrams. The Smart Utility Standards are intended to serve as guidelines for developers, architects, engineers, and utility providers for planning, designing, and locating utilities. The Smart Utility Standards will serve as the baseline for discussions on any deviations from the standards needed/proposed for any given utility infrastructure.

Please submit typical below and above grade cross section diagrams of all utility infrastructure in the proposed development area (including infrastructure related to the applicable SUTs).



# Boston Smart Utilities Checklist

Please submit typical below and above grade lateral diagrams of all utility infrastructure in the proposed development area (including infrastructure related to the applicable SUTs).

Please email submission to [travis.anderson@boston.gov](mailto:travis.anderson@boston.gov)

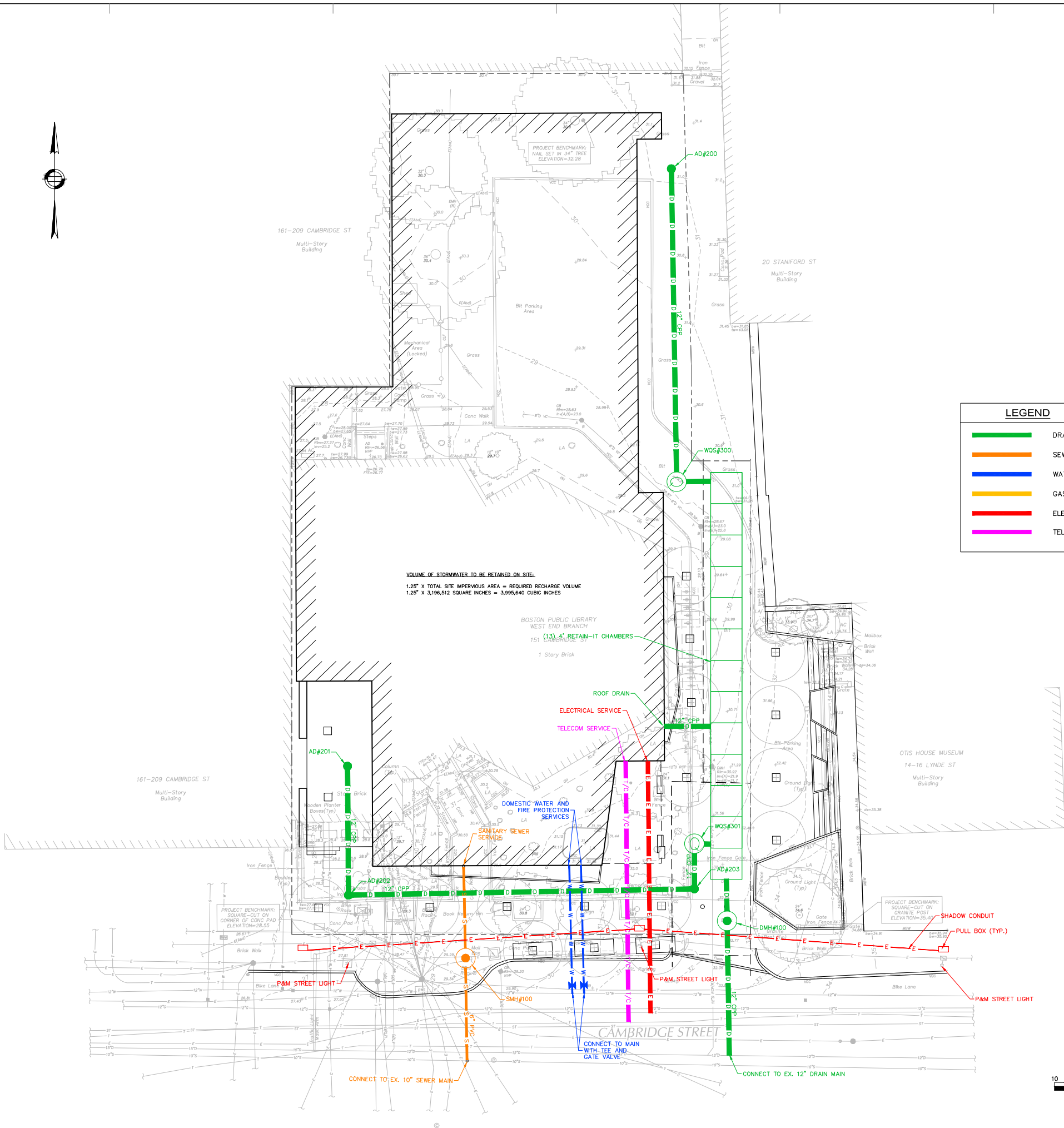
**7.1 Date Cross Section Diagram(s) was submitted**

**7.2 Date Lateral Diagram(s) was submitted**

01/07/2025

**7.3 Additional Information**

N/A



Consultant:

Revision:

Architect of Record:

Drawn: MF

Checked: JRH

Scale: AS NOTED

Key Plan:

Project Name:

West End Library

151 Cambridge Street

Sheet Name:

Smart Utilities Plan

Project Number:

Issue Date:

Sheet Number:

SU-01

## **Appendix D – WUFI Modeling Analysis**

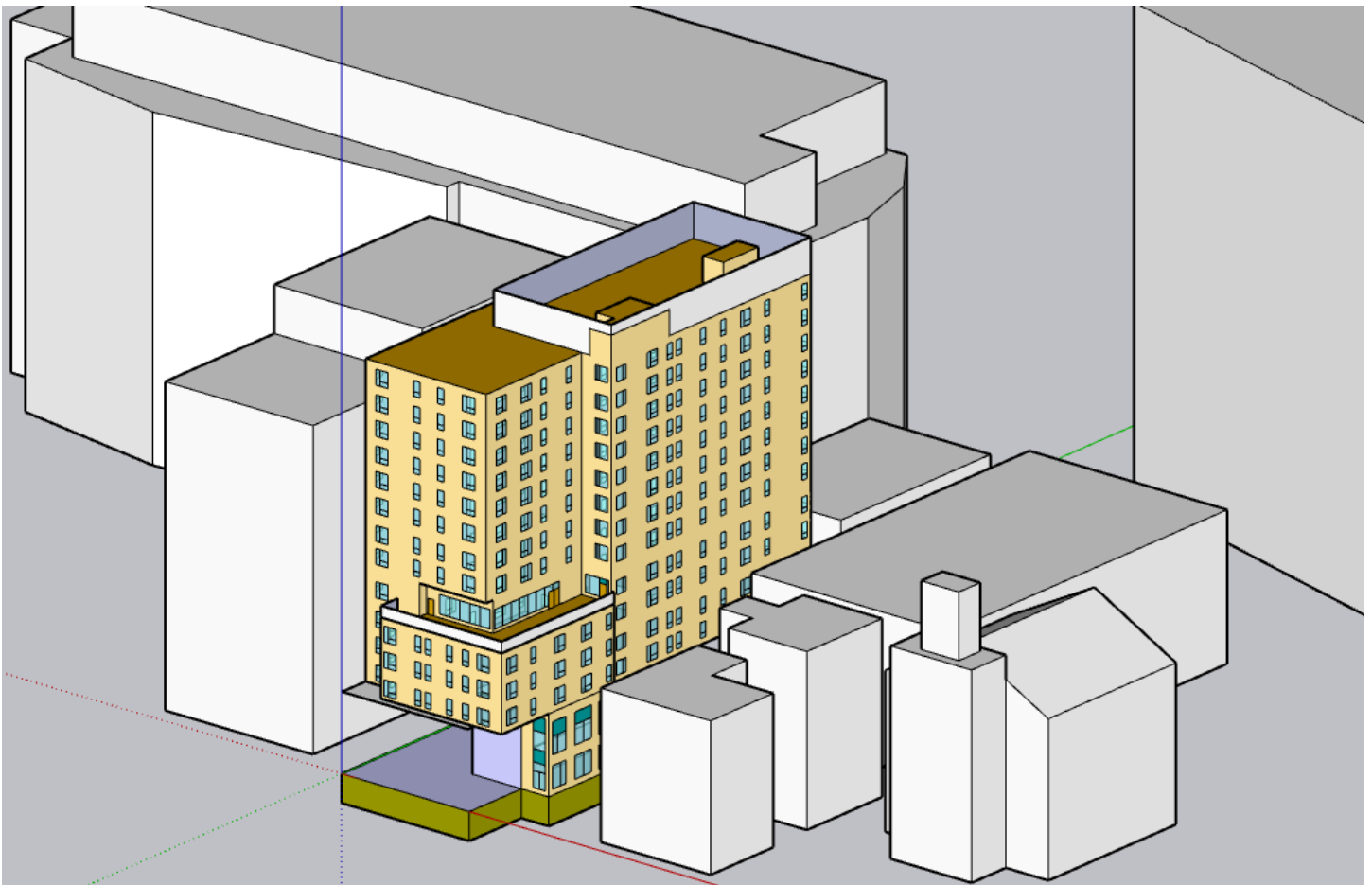


# PASSIVE HOUSE FEASIBILITY REPORT

PNF

## West End Library Development

151 Cambridge St, Boston, MA 02114



Prepared by:

enviENERGY Studio

Date:

December 13, 2024

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## EXECUTIVE SUMMARY

enviENERGY Studio is providing Passive House (Phius) consulting services for the West End Library development project and is investigating the project's compliance with the Massachusetts Stretch Energy Code. The proposed project is the construction of a new 14-story income-restricted multifamily building with the first two stories dedicated to the West End branch of the Boston Public Library. The residential portion of the development will seek Stretch Energy Code compliance via the Certified Performance Standard pathway. The library's shell on the first two floors is eligible for Prescriptive Compliance. The scope of this Passive House feasibility study is limited to the residential portion and common spaces dedicated to the residential program. This report also includes a preliminary vertical component performance evaluation of the library, following C402.1.5 of the Stretch Energy Code.

The building performance simulation was developed utilizing the provided conceptual design drawings, mechanical equipment narratives, and the Phius 2024 *Passive Building Standard Certified Guidebook*, v24.1.1. The study and analysis presented in this report focus on aspects of the building envelope and mechanical equipment performance to enhance thermal comfort, mitigate moisture and condensation risk, lower annual and peak loads from heating and cooling, and ultimately reduce energy consumption by the proposed building.

Utilizing the WUFI® Passive modeling software, this energy analysis shows that the proposed residential design meets and exceeds the Phius 2024 Performance Criteria. Note that the results below appear to indicate that the Source Energy is not met, but this is because the WUFI software does not yet reflect the Phius Performance Criteria Targets adjustments between 2021 and 2024. The "Electricity Mix" source factor for Phius 2024 has been increased to 2.0 from 1.8 (Phius 2021).<sup>1</sup> The actual source energy target for this project is **5,475 kWh/Person yr** (see Figure 2), which is well **above the 4,947 kWh/Person yr** shown below.

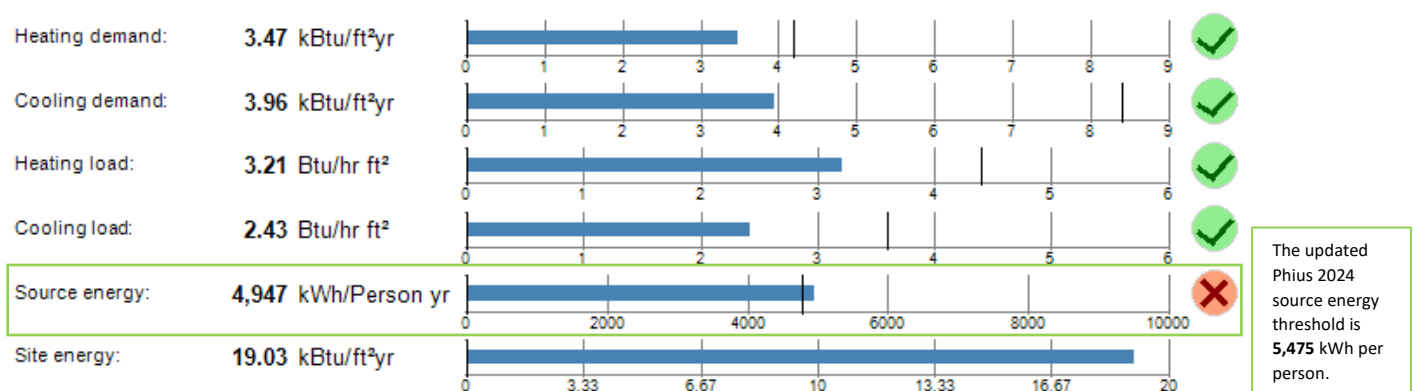


Figure 1: WUFI Passive Results for West End Library Housing

<sup>1</sup> <https://www.phius.org/phius-2024-standard-release-latest-and-greatest>

**Phius 2024**  
New Construction\*

Performance Criteria Calculator v24.1

UNITS: IMPERIAL (IP)

BUILDING FUNCTION: RESIDENTIAL

STATE / PROVINCE: MASSACHUSETTS

CITY: BOSTON LOGAN INT ARF

ASHRAE 169 Climate Zone: 5A

Envelope Area (ft²): 117,912.0

iCFA (ft²): 138,340.0

Dwelling Units (Count): 119

Total Bedrooms (Count): 193

Space Conditioning Criteria

Annual Heating Demand	4.2	kBtu/ft²·yr
Annual Cooling Demand	8.4	kBtu/ft²·yr
Peak Heating Load	4.4	Btu/ft²·hr
Peak Cooling Load	3.6	Btu/ft²·hr

Source Energy Criteria

Phius CORE	5475	kWh/person.yr
Phius ZERO	0	kWh/person.yr

\*Retrofit projects that qualify for the Phius REVIVE 2024 standard should refer to the Phius Certification Guidebook v24.1 for guidance and requirements.

**Figure 2: Phius 2024 Performance Criteria for West End Library Housing**

**\*Note:** WUFI Passive is an envelope compliance tool rather than an energy estimation tool. This report's predicted energy use intensity (pEUI) does not necessarily represent actual building energy performance. Phius uses default values for interior lighting and miscellaneous equipment and does not align with the ASHRAE energy modeling procedures.

## ENVELOPE CALCULATIONS (LIBRARY)

While the residential portion of the building will seek Certified Performance Standard Compliance, the library will seek Prescriptive compliance as a nonresidential portion of the development less than 20,000 square feet. Initial envelope calculations classify this portion of the building as a *Low Glazed Wall System Building* with 29% Window-to-Wall ratio, which requires the Area-weighted U values of above grade wall and fenestration values be  $\leq 0.1285$ . The following calculations confirms compliance.

VERTICAL ELEMENT	SQFT	%	U-Value	AxU
GLAZED WALL SYSTEM	3,736	24.1%	0.25	0.0603
PUNCH WINDOWS	1,011	6.5%	0.30	0.0196
EXTERIOR WALLS	10,611	68.5%	0.055	0.0377
GLASS DOOR	82	0.5%	0.63	0.0033
OPAQUE DOOR	45	0.3%	0.37	0.0011
<b>TOTAL</b>	15,485			<b>0.1220</b>

## ENERGY MODELING ASSUMPTIONS AND APPROACH

Using the guidelines outlined in Phius 2024 *Passive Building Standard Certified Guidebook* v24.1.1, a baseline was defined using the building enclosure requirements featured in the Preservation of Affordable Housing's (POAH) Basis of Design (BOD)<sup>2</sup>. The building design was modeled in accordance with Phius 2024 Performance Path guidelines in terms of the building envelope, HVAC systems, domestic hot water (DHW) system, lighting, miscellaneous loads, and occupancy and equipment schedules.

At this stage, it is recommended to carry a 10-15% buffer in all compliance criteria categories to mitigate risk associated with thermal bridging and other design decisions that differ from the assumptions made in this report.

Building parameters for the Baseline and Proposed cases are summarized as follows\*:

---

<sup>2</sup> <https://www.poahbod.org/building-enclosure-new-construction#building-enclosure-newconstruction>

<b>Project Name:</b>	<b>West End Library Development Housing</b>	
<b>Case</b>	<b>Phius CORE 2024</b>	
<b>Exterior Envelope</b>	<b>Units</b>	<b>IP</b>
Interior Conditioned Floor Area (iCFA)	Square Feet	138,340
Roof	Insulation entirely above deck	R-49
Exterior Walls	Metal framed	R-13 (R-6 effective)+ R-20 ci
Walls Adjacent to Library	Metal framed	R-21 (R-9 effective)
Ceiling/Floor Adjacent to Library	Joist/framing	R-38 (28.12 effective)
Overhangs	Joist/framing	R-38 (28.12 effective)
Basement Walls	Below-grade wall	R-7.5 ci
Basement Slab	Slab on grade	R-8 ci below
Punch windows @ Units	U-window (mounted)	0.24
Full-height windows @ Amenity Spaces	U-window (mounted)	0.22
Windows (All)	COG SHGC	0.35
<b>Airtightness</b>	<b>Target</b>	<b>Units</b>
Envelope airtightness at 50 Pa	<b>0.06</b>	cfm50/ft2 (envelope)
		<b>(Phius 2024 - Target)</b>
		<b>0.06</b>
<b>Lighting</b>	<b>Units</b>	
Interior	kWh/yr	183,872
Exterior	kWh/yr	3,271
<b>Miscellaneous Electric Loads</b>	<b>Units</b>	
Typical MELs	kWh/yr	123,973
<b>Occupancy</b>	<b>Units</b>	
Occupancy	Phius default: # Bedrooms +	312
Bedrooms	Bedrooms	193
<b>Ventilation</b>	<b>Unit Type</b>	<b>CFM</b>
ERV - Design Airflow	Studio (1 kitchen + 1 bath)	75
	1 bedroom (1 kitchen + 1	75
	2 bedroom (1 kitchen + 1	75
	3 bedroom (1 kitchen + 2	100
<b>Mechanical Systems</b>	<b>Units</b>	
Rooftop ERV (Addison PROH or equal)	% Heat Recovery Efficiency	0.78
	% Humidity Recovery	0.4
	W/cfm	1.50
Daikon Emerion REYQ288AA (VRV)	Weighted Model Heating COP	3.12
	COP @ 17 °F	2.13
	COP @ 47 °F	3.27
	Cooling COP* (IEER)	5.66 (19.3)
<b>Domestic Hot Water</b>	<b>Units</b>	
Lync by Watts - Aegis A	-	Central, CO2 Air-Source Heat Pump
<b>WUFI Passive Model Results</b>	<b>Units</b>	
Predicted Energy Use Intensity	kBtu/sf	19.0
Source Energy Use Above/Below Threshold	%	<b>9.6%</b>

**\*Note:** The internal conditioned floor area (iCFA) used for the Phius Performance Criteria calculations is based on the conceptual drawings and may change as the design progresses. This may potentially alter the targeted performance criteria for this project.



## Building Envelope

The modeled building envelope assumes a thermally robust and airtight envelope. The elements of the envelope primarily consist of steel-framed insulated walls with punch windows. The table on page 6 summarizes the thermal performance of the proposed building envelope to comply with Phius performance requirements. The estimated window-to-wall ratio and proposed U/R values are based on the conceptual design and massing plans. As the design progresses, the project team will evaluate new technologies and approaches to improve the building design and optimize the overall envelope performance.

It is important to note that window U-value performance is based on the Phius Window Comfort & Condensation Risk Assessment Tool and is linked to the window's height. This results in a maximum window U-value U-0.22 for all storefront/curtainwall windows with a vertical window height of 8 feet at amenity and common spaces, and a maximum U-value of U-0.24 for punch windows at the residential units with a vertical height of 6.5 feet. Projects may only be exempt from complying with these performance values if: perimeter heating is installed within 3 feet of the window; windows are adjacent to non-regularly occupied areas; or are glazed assemblies are ADA doors. A value of U-0.24 (punch) and U-0.22 (SF/CW) is currently assumed as the proposed window assembly performance of the entire building.

## Building Airtightness

The Phius requirement for the maximum allowable infiltration rate is 0.06 CFM/ft<sup>2</sup> @ ±50 Pascals of pressure. This is significantly lower than the Massachusetts Stretch Energy Code maximum infiltration rate of 0.23 CFM/ft<sup>2</sup> @ ±50 Pascals of pressure. The detailed drawings will include a clear definition of the building's continuous air barrier, as well as individual details of all building component connections, penetrations, and window installations.

To meet these stringent requirements, the design and construction team will ensure that all joints, penetrations, and openings are adequately taped or sealed. The Phius Verifier will perform blower door testing at the end of construction to confirm the project's compliance with the air leakage requirements.

## Thermal Bridging

Note that thermal bridging is not accounted for in the scope of this submission because it is not required for feasibility study modeling but will be included in the WUFI Passive model for Design Certification using 2-D THERM analysis. Problematic thermal bridges can be mitigated through better-insulated and thermally broken constructions at critical junctions in the building envelope. If necessary, iterative design and modeling will be performed to optimize these building envelope connections and minimize the impact of unnecessary thermal bridging.

## Occupancy

Per the Phius 2024 Passive Building Standard Certified Guidebook V24.1.1, residential building loads and ventilation rates are established based on the assumption that these systems will operate 24/7. The peak occupancy density is calculated as the number of bedrooms plus one for residential spaces (note that studio apartments are counted as "0" bedrooms). The HVAC system will operate 24/7.

## Internal Loads

Phius mandates that the lighting and plug loads are calculated using the Phius Multifamily Lighting & MEL (miscellaneous electric loads) Calculator. These calculated values have been included in the WUFI model. All lighting is assumed to be LED, and common areas are assumed to have occupancy sensors. All equipment such as washer machines, dryers, and dishwashers currently assume the national average for ENERGY STAR rated appliances. These values must be updated as equipment is specified for the project.

## Mechanical Ventilation

The proposed ERV systems utilize centralized rooftop ERV units, which distribute preconditioned air to the dwelling units and common areas. Building ventilation rates at this stage were estimated to be a mixture of DOE Zero Energy Ready Homes (ZERH) ventilation requirements for dwelling units in large multifamily buildings and ASHRAE 62.1 ventilation requirements for non-residential spaces.

It is important to note that the total measured supply and exhaust airflows must be within 10% of each other. Additionally, the proposed ERV equipment must meet the following requirements for indoor air quality:

- Install MERV 8 filter on the supply intake ductwork (recommend MERV 13 or higher).
- Install MERV 8 filter on the exhaust ductwork.

## Space Heating and Cooling

Heating and cooling equipment for the proposed design includes a central VRV system. The WUFI Passive tool is limited to 682 kBtu/hr. The proposed Cooling Capacity of this project is larger than this, requiring five (5) separate systems to be modeled with the following parameters:

**Table 1: WUFI® Passive Cooling Equipment Inputs**

Equipment Parameter (Cooling)	Model Input (per modeled system)
Recirculation Air Flow Rate/System	13,700 CFM (x5)
Model Cooling Capacity/System	548 kBtu/hr (x5)
Model Cooling COP	5.66
Number of Systems Needed	5

**Table 2: WUFI® Passive Heating Equipment Inputs**

Equipment (Heating) Parameter	Model Input
Rated COP (17 °F)	2.13
Rated COP (47 °F)	3.27

## Setpoints

Temperature setpoints were entered as prescribed for the Phius CORE 2024 certification. See below for the setpoints used.

Heating set point: 68 °F

Cooling set point: 77 °F

## Domestic Hot Water

The DHW system in the proposed design includes a central air-to-water heat pump hot water heater with a storage tank. This system meets the Phius source energy requirement.

In addition to the proposed DHW design, the following criteria must be met (per DOE ZERH v2):

- WaterSense labeled fixtures for dwelling unit showerheads, bath faucets, and aerators;
- insulate recirculating central hot water pipes with a minimum of R10 (<1.5" pipes) or R12 (≥ 1.5" pipes);
- and no more than 1.8 gallons of stored water between the DHW and any hot water fixture.<sup>3</sup>

## DOE Zero Energy Ready Homes (ZERH)

Phius requires certification under the National Multifamily Version 2 program.

### PV-Ready Checklist Version 2

Since this building will be all-electric with no fossil fuel usage, it does not have to comply with the Specialized Opt-in Code requirement to install solar PV onsite. However, for Phius CORE 2024 certification, a project must comply with the U.S. DOE Zero Energy Ready Home Multifamily PV-Ready Checklist Version 2. This includes reserving a solar-ready area that is at least 40% of roof area (including occupied roof decks, vegetated roof areas and mandatory access or set back areas). Exceptions include receiving energy from a community solar system, shading for more than 70% of daylight hours annually, and roof slope and orientation.<sup>4</sup>

### EV-Ready Checklist Version 2

The U.S. DOE Zero Energy Ready Home Multifamily EV-Ready Checklist Version 2 requires 10% of parking allocated to the residential building to be EV-ready and 10% of parking allocated for the full installment of Electric Vehicle Supply Equipment (EVSE).<sup>5</sup> This requirement is not applicable to this project because parking spaces are not included in the design.

## ENERGY STAR Multifamily New Construction (MFNC)

Phius requires certification under the National Version 1.2 of the EPA ENERGY STAR Multifamily New Construction (MFNC) program. This entails three potential pathways for compliance: Prescriptive, ERI (Energy Rating Index), and ASHRAE. The intention for this project is to pursue the ERI Path. This requires each individual unit's HERS rating to be equivalent to the minimum requirements of the ENERGY STAR Multifamily Reference Design, Exhibit 1, as assessed by an EPA-recognized Home Certification Organization (HCO).<sup>6</sup>

<sup>3</sup> [DOE ZERH Multifamily National Program Requirements Version 2.pdf](#)

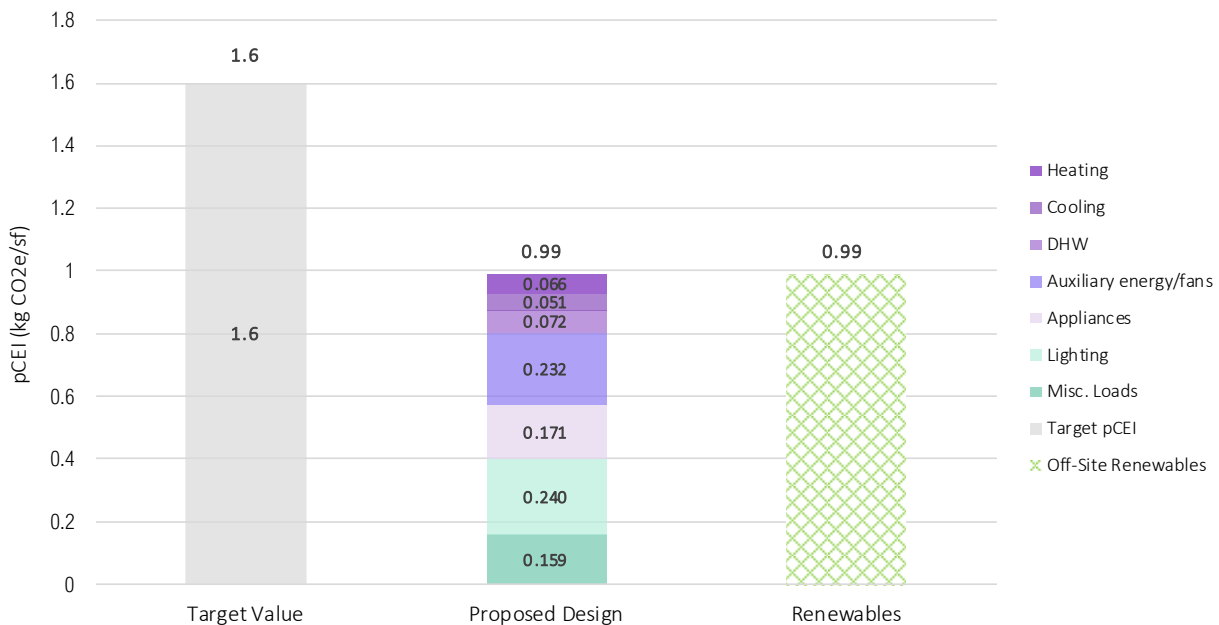
<sup>4</sup> [DOE ZERH Multifamily PV-Ready Checklist Version 2.pdf](#)

<sup>5</sup> [DOE ZERH Multifamily EV-Ready Checklist Version 2.pdf](#)

<sup>6</sup> [ENERGY STAR Multifamily New Construction National Program Requirements, Version 1.2 \(Rev. 04\) Revised](#)

## OPERATIONAL ENERGY AND CARBON ANALYSIS

To align with the predicted carbon emissions intensity (pCEI) thresholds established in the Draft Proposed Zoning Update to Article 37<sup>7</sup>, the figure below outlines the site energy and carbon emissions, organized by end-use, for the proposed design. The renewables bar refers to the estimated solar energy generated on-site and the necessary off-site renewable energy procurement to make the building net zero. The pCEI for the proposed building is 0.99 kg CO<sub>2</sub>e/sf-year, which falls below the 1.6 kg CO<sub>2</sub>e/sf-year.



**Figure 3: Proposed Case vs. Target Value pCEI**

Since this is an all-electric building, the percentage of site energy per end use is the same as that of pCEI. Tabulated site energy and pCEI results of the proposed design can be found below.

**Table 3: End Use Breakdown (Energy & Carbon)**

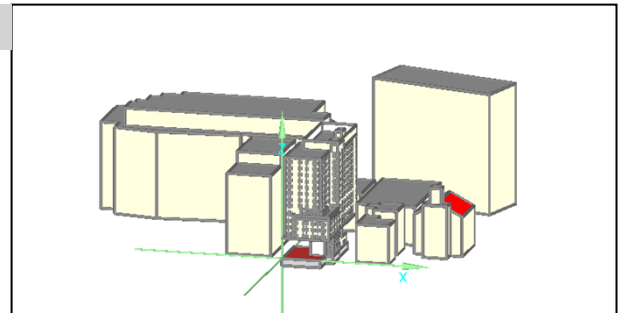
End Use	Site Energy (kWh)	2035 pCEI (kg CO <sub>2</sub> e/sf-yr)
Heating	51,391	0.066
Cooling	39,316	0.051
DHW	56,331	0.072
Auxiliary energy/fans	180,201	0.232
Appliances	133,310	0.171
Lighting	187,143	0.240
Misc. Loads	123,973	0.159
Totals	771,666	0.99

The WUFI® Passive report summarizes the inputs and outputs used in the feasibility study to generate this report and can be found on the following pages.

<sup>7</sup> <https://www.bostonplans.org/getattachment/708944cf-ff5a-4d68-83a0-29a912bdd8a0>

## BUILDING INFORMATION

Category:	<b>Residential</b>
Status:	<b>In planning</b>
Building type:	<b>New construction</b>
Year of construction:	
Units:	<b>119</b>
Number of occupants:	<b>312 (Design)</b>
Occupant density:	<b>443.4 ft<sup>2</sup>/Person</b>



## Boundary conditions

Climate:	<b>BOSTON LOGAN INT ARPT MA</b>
Internal heat gains:	<b>1.2 Btu/hr ft<sup>2</sup></b>
Interior temperature:	<b>68 °F</b>
Overheat temperature:	<b>77 °F</b>

## Building geometry

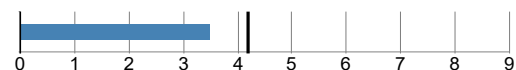
Enclosed volume:	<b>1,701,363.1 ft<sup>3</sup></b>
Net-volume:	<b>1,293,036 ft<sup>3</sup></b>
Total area envelope:	<b>97,598.4 ft<sup>2</sup></b>
Area/Volume Ratio:	<b>0.1 1/ft</b>
Floor area:	<b>138,340 ft<sup>2</sup></b>
Envelope area/iCFA:	<b>0.705</b>

## PASSIVEHOUSE REQUIREMENTS

**Certificate criteria:** **Phius CORE 2021**

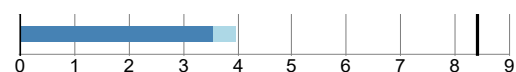
### Heating demand

specific:	<b>3.47 kBtu/ft<sup>2</sup>yr</b>
target:	<b>4.2 kBtu/ft<sup>2</sup>yr</b>
total:	<b>480,095.17 kBtu/yr</b>



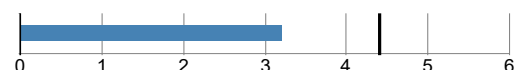
### Cooling demand

sensible:	<b>3.54 kBtu/ft<sup>2</sup>yr</b>
latent:	<b>0.41 kBtu/ft<sup>2</sup>yr</b>
specific:	<b>3.96 kBtu/ft<sup>2</sup>yr</b>
target:	<b>8.4 kBtu/ft<sup>2</sup>yr</b>
total:	<b>547,302.66 kBtu/yr</b>



### Heating load

specific:	<b>3.21 Btu/hr ft<sup>2</sup></b>
target:	<b>4.4 Btu/hr ft<sup>2</sup></b>
total:	<b>444,067.73 Btu/hr</b>



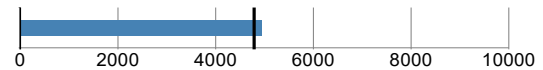
### Cooling load

specific:	<b>2.43 Btu/hr ft<sup>2</sup></b>
target:	<b>3.6 Btu/hr ft<sup>2</sup></b>
total:	<b>335,829.36 Btu/hr</b>



### Source energy

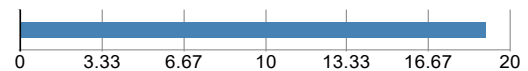
total: **1,543,331.91** kWh/yr  
specific: **4,947** kWh/Person yr  
target: **4,775** kWh/Person yr  
total: **5,265,547.3** kBtu/yr  
specific: **38.07** kBtu/ft²yr



Phius CORE 2024 target is 5,475 kWh/Person. WUFI software has not yet been updated to reflect 2024 criteria. This project complies the 2024 target with a 9.6% savings.

### Site energy

total: **2,632,773.65** kBtu/yr  
specific: **19.03** kBtu/ft²yr  
total: **771,665.96** kWh/yr  
specific: **5.58** kWh/ft²



### Air tightness

ACH50: **0.33** 1/hr  
CFM50 per envelope area: **0.06** cfm/ft²  
target: **0.33** 1/hr  
target CFM50: **0.06** cfm/ft²

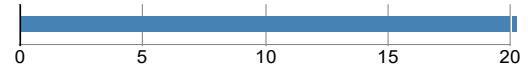


## PASSIVEHOUSE RECOMMENDATIONS

Sensible recovery efficiency: **70.9** %



Frequency of overheating: **44.8** %  
Cooling system is required



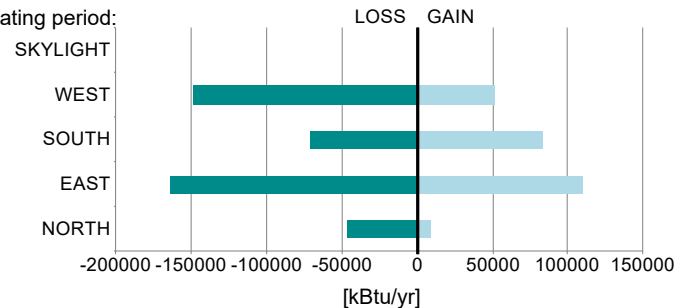
Frequency of overheating only applies if there is not a [properly sized] cooling system installed.



## BUILDING ELEMENTS

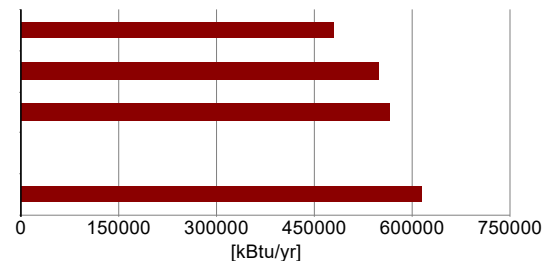
## Windows

		Heat gain/loss heating period:
Average SHGC:	<b>0.35</b>	
Average solar reduction factor heating:	<b>0.44</b>	
Average solar reduction factor cooling:	<b>0.47</b>	
Average U-value:	<b>0.236</b>	Btu/hr ft <sup>2</sup> °F
Total glazing area:	<b>12,876.2</b>	ft <sup>2</sup>
Total window area:	<b>12,888.9</b>	ft <sup>2</sup>



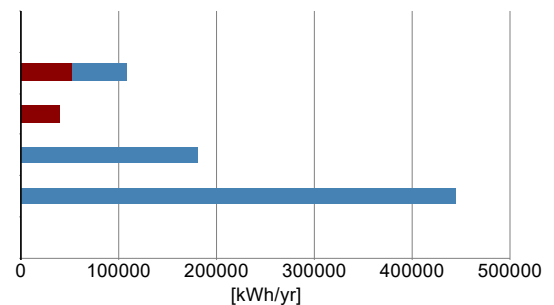
## HVAC

Total heating demand:	<b>480,095</b>	kBtu/yr
Total cooling demand:	<b>547,303</b>	kBtu/yr
Total DHW energy demand:	<b>565,267</b>	kBtu/yr
Solar DHW contribution:	<b>0</b>	kBtu/yr
Auxiliary electricity:	<b>614,810</b>	kBtu/yr



## Electricity

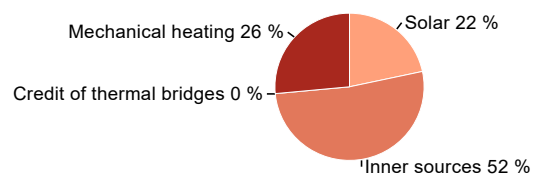
Direct heating / DHW:	<b>0</b>	kWh/yr
Heatpump heating:	<b>107,723</b>	kWh/yr
Cooling:	<b>39,316</b>	kWh/yr
HVAC auxiliary energy:	<b>180,201</b>	kWh/yr
Appliances:	<b>444,426</b>	kWh/yr
Renewable generation, coincident production and use:	<b>0</b>	kWh/yr
Total electricity demand:	<b>771,666</b>	kWh/yr



## HEAT FLOW - HEATING PERIOD

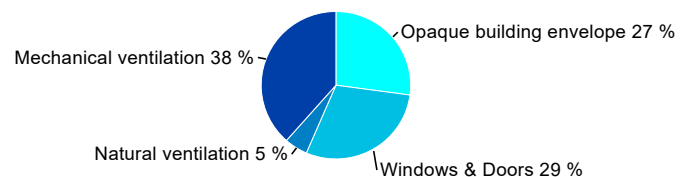
## Heat gains

Solar:	<b>338,062</b>	kBtu/yr
Inner sources:	<b>809,826</b>	kBtu/yr
Credit of thermal bridges:	<b>0</b>	kBtu/yr
Mechanical heating:	<b>480,095</b>	kBtu/yr



## Heat losses

Opaque building envelope:	<b>441,597</b>	kBtu/yr
Windows & Doors:	<b>477,859</b>	kBtu/yr
Natural ventilation:	<b>82,048</b>	kBtu/yr
Mechanical ventilation:	<b>626,480</b>	kBtu/yr

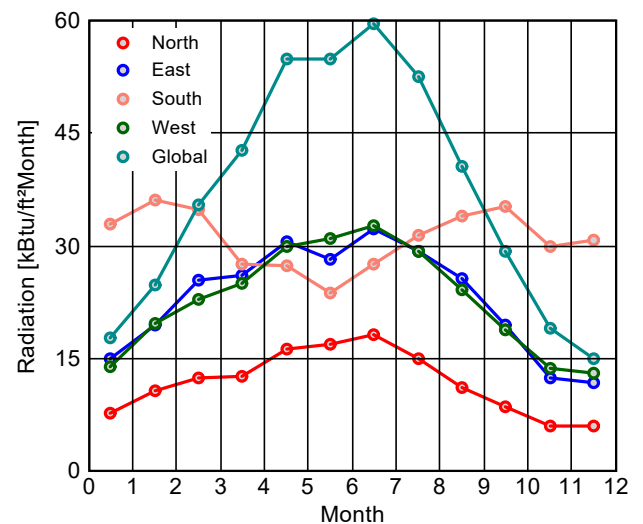
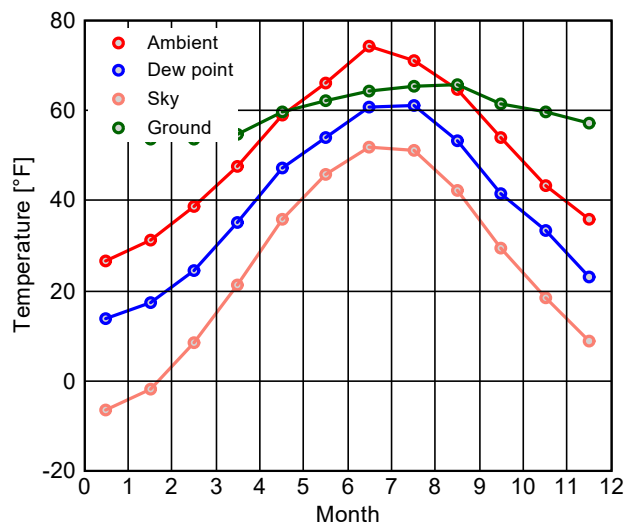


## CLIMATE

Latitude: **42.4 °**  
 Longitude: **-71 °**  
 Elevation of weather station: **19.7 ft**  
 Elevation of building site: **26 ft**  
 Heat capacity air: **0.018 Btu/ft³F**  
 Daily temperature swing summer: **14.8 °F**  
 Average wind speed: **13.1 ft/s**

## Ground

Average ground surface temperature: **52.8 °F**  
 Amplitude ground surface temperature: **55.8 °F**  
 Ground thermal conductivity: **1.2 Btu/hr ft °F**  
 Ground heat capacity: **29.8 Btu/ft³F**  
 Depth below grade of groundwater: **9.8 ft**  
 Flow rate groundwater: **0.2 ft/d**



## Calculation parameters

Length of heating period: **243 days/yr**  
 Heating degree hours: **141.3 kFh/a**  
 Phase shift months: **1.3 mths**  
 Time constant heating demand: **135.7 hr**  
 Time constant cooling demand: **0 hr**  
 Time constant cooling demand with night ventilation: **0 hr**

Climate for	Heating load 1	Heating load 2	Cooling
Temperature [°F]	16.9	31.6	83.5
Solar radiation North [Btu/hr ft²]	12	7.9	27.6
Solar radiation East [Btu/hr ft²]	22.8	13.3	61.5
Solar radiation South [Btu/hr ft²]	49.5	27.3	41.8
Solar radiation West [Btu/hr ft²]	22.2	11.4	53.3
Solar radiation Global [Btu/hr ft²]	26.9	16.5	101.4

Relevant boundary conditions for heating load calculation: Heating load 1

## ANNUAL HEAT DEMAND

Transmission losses : **919,456** kBtu/yr  
 Ventilation losses: **708,528** kBtu/yr  
 Total heat losses: **1,627,984** kBtu/yr

Solar heat gains: **392,583** kBtu/yr  
 Internal heat gains: **940,431** kBtu/yr  
 Total heat gains: **1,333,014** kBtu/yr  
 Utilization factor: **86.1** %  
 Useful heat gains: **1,147,889** kBtu/yr

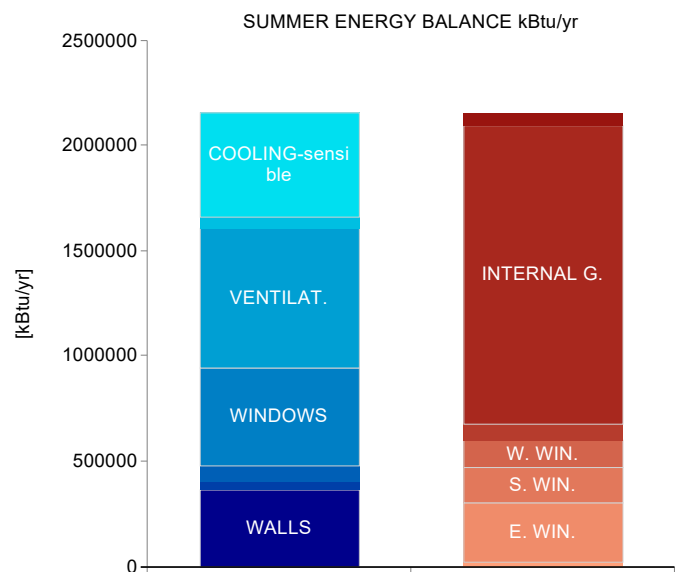
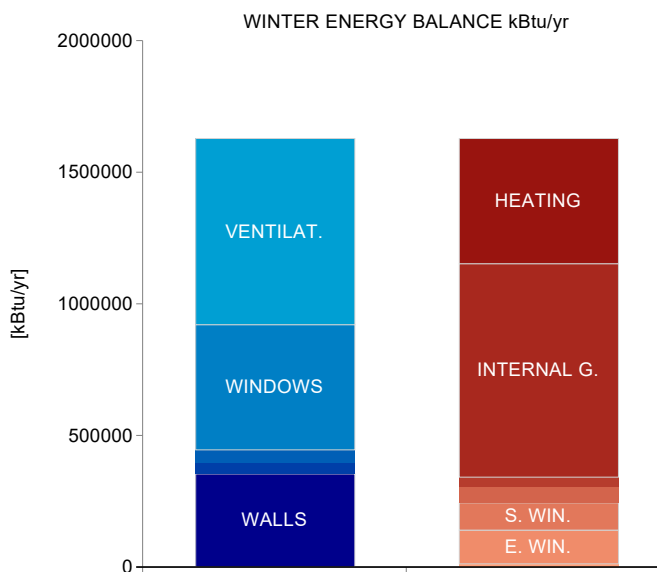
Annual heat demand: **480,095** kBtu/yr  
 Specific annual heat demand: **3,470.7** Btu/ft<sup>2</sup>yr

## ANNUAL COOLING DEMAND

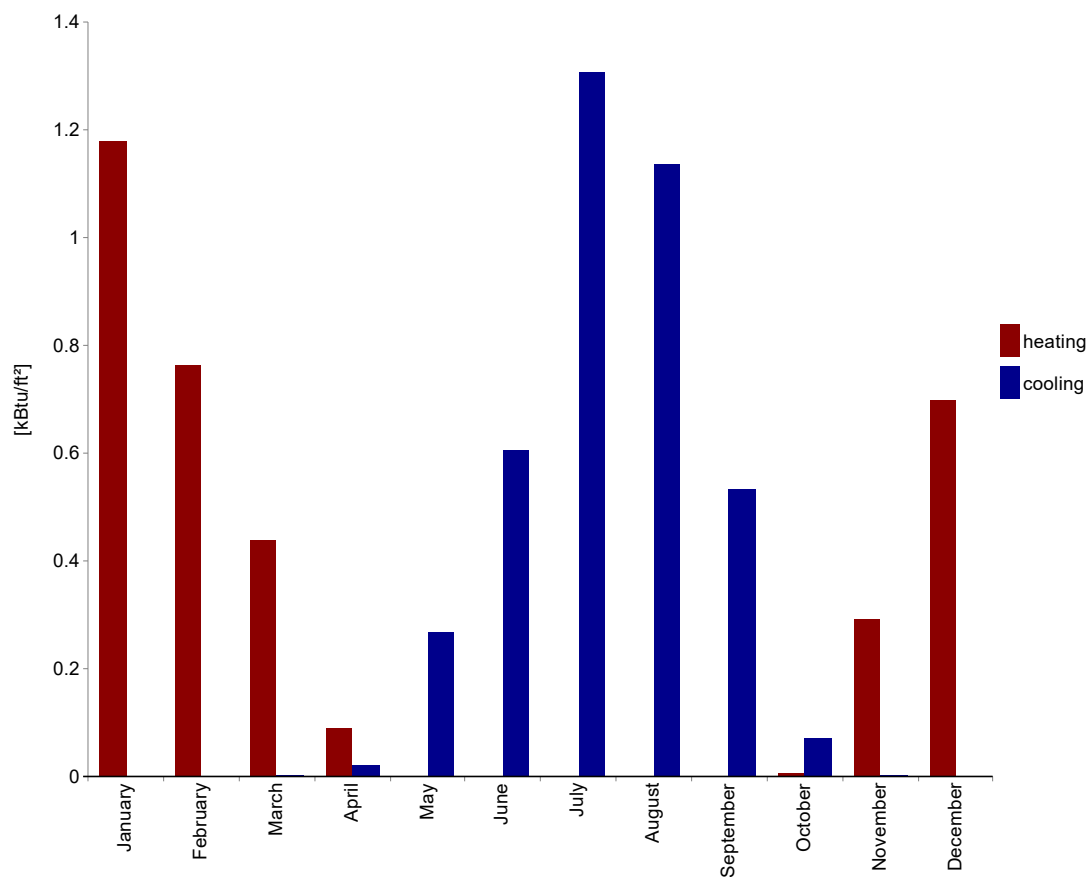
Solar heat gains: **677,322** kBtu/yr  
 Internal heat gains: **1,417,128** kBtu/yr  
 Total heat gains: **2,094,450** kBtu/yr

Transmission losses : **1,479,936** kBtu/yr  
 Ventilation losses: **1,032,880** kBtu/yr  
 Total heat losses: **2,512,816** kBtu/yr  
 Utilization factor: **63.8** %  
 Useful heat losses: **1,604,168** kBtu/yr

Cooling demand - sensible: **490,282** kBtu/yr  
 Cooling demand - latent: **57,020** kBtu/yr  
 Annual cooling demand: **547,303** kBtu/yr  
 Specific annual cooling demand: **4** kBtu/ft<sup>2</sup>yr



## SPECIFIC HEAT/COOLING DEMAND MONTHLY



Month	Heating [kBtu/ft²]	Cooling [kBtu/ft²]
January	1.2	0
February	0.8	0
March	0.4	0
April	0.1	0
May	0	0.3
June	0	0.6
July	0	1.3
August	0	1.1
September	0	0.5
October	0	0.1
November	0.3	0
December	0.7	0

## HEATING LOAD

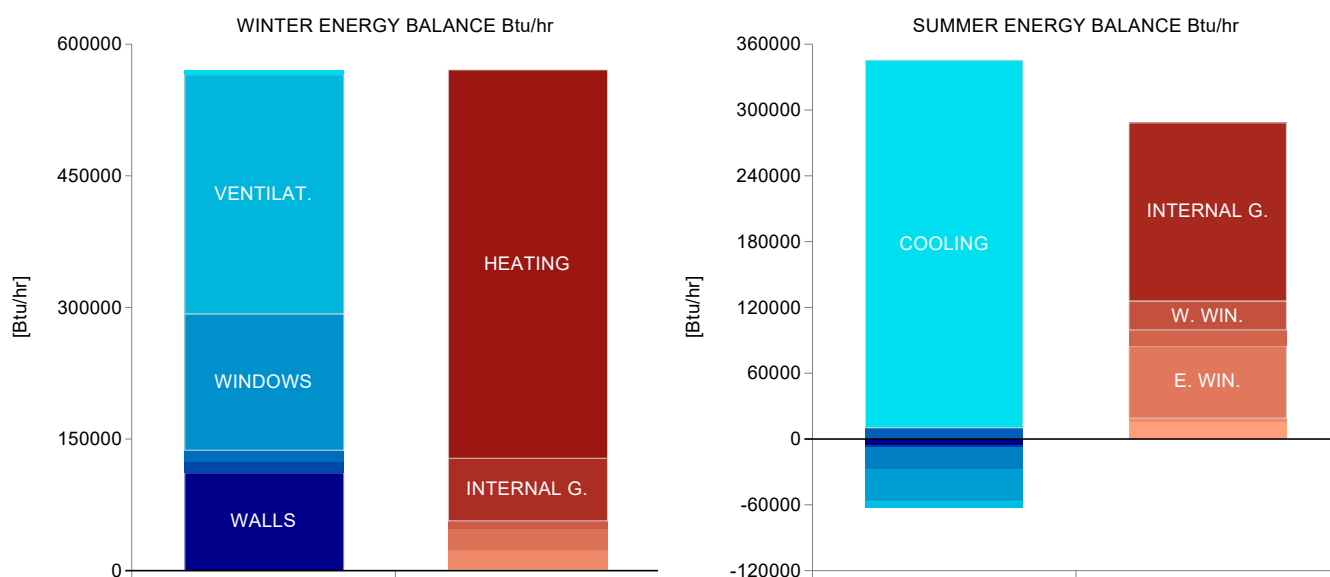
	First climate	Second climate
Transmission heat losses:	<b>297,521.4</b> Btu/hr	<b>218,912.3</b> Btu/hr
Ventilation heat losses:	<b>273,123.7</b> Btu/hr	<b>194,296.1</b> Btu/hr
Total heat loss:	<b>570,645.2</b> Btu/hr	<b>413,208.4</b> Btu/hr
Solar heat gain:	<b>56,411.8</b> Btu/hr	<b>31,597.5</b> Btu/hr
Internal heat gain:	<b>70,165.6</b> Btu/hr	<b>70,165.6</b> Btu/hr
Total heat gains heating:	<b>126,577.4</b> Btu/hr	<b>101,763.1</b> Btu/hr
Heating load:	<b>444,067.7</b> Btu/hr	<b>311,445.3</b> Btu/hr

Relevant heating load: **444,067.7** Btu/hr  
 Specific heating load: **3.2** Btu/hr ft<sup>2</sup>

## COOLING LOAD

Solar heat gain:	<b>125,712.3</b> Btu/hr
Internal heat gain:	<b>161,788.5</b> Btu/hr
Total heat gains cooling:	<b>287,500.9</b> Btu/hr
Transmission heat losses:	<b>-18,937.5</b> Btu/hr
Ventilation heat losses:	<b>-29,391</b> Btu/hr
Total heat loss:	<b>-48,328.5</b> Btu/hr
Cooling load - sensible:	<b>335,829.4</b> Btu/hr
Cooling load - latent:	<b>0</b> Btu/hr

Relevant cooling load: **335,829.4** Btu/hr  
 Specific maximum cooling load: **2.4** Btu/hr ft<sup>2</sup>



## AREAS

Name	Area [ft²]	Average U-value [Btu/hr ft² °F]	Absorption coefficient	Emission coefficient	Reduction factor shading [%]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.1: Floor Over Library: Horizontal (1337.48 ft², width 25.519 ft)	1337.5	0.034	0	0	0	0	0
VC.1: Floor Over Library: Horizontal (8508.15 ft², width 74.136 ft)	8508.2	0.034	0	0	0	0	0
VC.2: Wall to Library: West (A270°, 176.2 ft², width 19.578 ft)	176.2	0.1	0	0	0	0	0
VC.2: Wall to Library: South (A180°, 42.84 ft², width 4.76 ft)	42.8	0.1	0	0	0	0	0
VC.2: Wall to Library: West (A270°, 328.36 ft², width 36.484 ft)	328.4	0.1	0	0	0	0	0
VC.2: Wall to Library: North (A0°, 229.67 ft², width 25.519 ft)	229.7	0.1	0	0	0	0	0
VC.2: Wall to Library: North (A0°, 614.77 ft², width 36.163 ft)	614.8	0.1	0	0	0	0	0
VC.2: Wall to Library: South (A180°, 822.78 ft², width 24.199 ft)	822.8	0.1	0	0	0	0	0
VC.2: Wall to Library: West (A270°, 2620.83 ft², width 91.703 ft)	2620.8	0.1	0	0	0	0	0
VC.2: Wall to Library: North (A0°, 614.77 ft², width 36.163 ft)	614.8	0.1	0	0	0	0	0
VC.3: Exterior Walls: North (A0°, 208.28 ft², width 19.526 ft)	208.3	0.034	0.4	0.9	100	1095.8	1681.6
VC.3: Exterior Walls: West (A270°, 217.83 ft², width 20.422 ft)	217.8	0.034	0.4	0.9	100	1146.1	1758.7
VC.3: Exterior Walls: North (A0°, 6590.08 ft², width 58.136 ft)	6590.1	0.034	0.4	0.9	100	34673	53205.7
VC.3: Exterior Walls: West (A270°, 8291.94 ft², width 81.708 ft)	8291.9	0.034	0.4	0.9	100	43627.1	66945.8
VC.3: Exterior Walls: North (A0°, 108.89 ft², width 10.208 ft)	108.9	0.034	0.4	0.9	100	572.9	879.1
VC.3: Exterior Walls: West (A270°, 223.06 ft², width 20.911 ft)	223.1	0.034	0.4	0.9	100	1173.6	1800.9
VC.3: Exterior Walls: South (A180°, 108.89 ft², width 10.208 ft)	108.9	0.034	0.4	0.9	100	572.9	879.1
VC.3: Exterior Walls: East (A90°, 223.06 ft², width 20.911 ft)	223.1	0.034	0.4	0.9	100	1173.6	1800.9
VC.3: Exterior Walls: South (A180°, 96.11 ft², width 9.01 ft)	96.1	0.034	0.4	0.9	100	505.7	776
VC.3: Exterior Walls: West (A270°, 156.32 ft², width 14.655 ft)	156.3	0.034	0.4	0.9	100	822.5	1262.1
VC.3: Exterior Walls: East (A90°, 11.33 ft², width 5.667 ft)	11.3	0.034	0.4	0.9	100	59.6	91.5
VC.3: Exterior Walls: East (A90°, 46.5 ft², width 9 ft)	46.5	0.034	0.4	0.9	100	244.7	375.4
VC.3: Exterior Walls: East (A90°, 55.33 ft², width 4.064 ft)	55.3	0.034	0.4	0.9	100	291.1	446.7
VC.3: Exterior Walls: North (A0°, 50.19 ft², width 1.521 ft)	50.2	0.034	0.4	0.9	100	264.1	405.2
VC.3: Exterior Walls: East (A90°, 1113.4 ft², width 52.333 ft)	1113.4	0.034	0.4	0.9	100	5858	8989.1
VC.3: Exterior Walls: South (A180°, 7 ft², width 3.5 ft)	7	0.034	0.4	0.9	100	36.8	56.5
VC.3: Exterior Walls: South (A180°, 1500.67 ft², width 59.657 ft)	1500.7	0.034	0.4	0.9	100	7895.6	12115.8
VC.3: Exterior Walls: South (A180°, 228.61 ft², width 32.932 ft)	228.6	0.034	0.4	0.9	100	1202.8	1845.7
VC.3: Exterior Walls: East (A90°, 50.38 ft², width 9.75 ft)	50.4	0.034	0.4	0.9	100	265	406.7
VC.3: Exterior Walls: East (A90°, 1763.45 ft², width 67.62 ft)	1763.5	0.034	0.4	0.9	100	9278.2	14237.4
VC.3: Exterior Walls: South (A180°, 281.47 ft², width 13.485 ft)	281.5	0.034	0.4	0.9	100	1480.9	2272.5
VC.3: Exterior Walls: South (A180°, 33 ft², width 6 ft)	33	0.034	0.4	0.9	100	173.6	266.4
VC.3: Exterior Walls: South (A180°, 36 ft², width 6 ft)	36	0.034	0.4	0.9	100	189.4	290.6
VC.3: Exterior Walls: North (A0°, 1644 ft², width 16 ft)	1644	0.034	0.4	0.9	100	8649.7	13273
VC.3: Exterior Walls: East (A90°, 48 ft², width 8 ft)	48	0.034	0.4	0.9	100	252.5	387.5
VC.3: Exterior Walls: East (A90°, 723.32 ft², width 39.37 ft)	723.3	0.034	0.4	0.9	100	3805.7	5839.8
VC.3: Exterior Walls: North (A0°, 51.71 ft², width 1.521 ft)	51.7	0.034	0.4	0.9	100	272.1	417.5
VC.3: Exterior Walls: East (A90°, 4565.63 ft², width 57.361 ft)	4565.6	0.034	0.4	0.9	100	24021.6	36861.1
VC.3: Exterior Walls: South (A180°, 4939.24 ft², width 59.526 ft)	4939.2	0.034	0.4	0.9	100	25987.3	39877.5
VC.3: Exterior Walls: West (A270°, 10294.36 ft², width 95.715 ft)	10294.4	0.034	0.4	0.9	100	54162.6	83112.6
VC.3: Exterior Walls: West (A270°, 280.05 ft², width 10.259 ft)	280	0.034	0.4	0.9	100	1473.5	2261
VC.3: Exterior Walls: South (A180°, 1178.99 ft², width 14.609 ft)	1179	0.034	0.4	0.9	100	6203.2	9518.7
VC.3: Exterior Walls: East (A90°, 13485.74 ft², width 120.063 ft)	13485.7	0.034	0.4	0.9	100	70953.7	108878.5
VC.4: Roof: Horizontal (552.87 ft², width 19.526 ft)	552.9	0.02	0.4	0.9	100	1728.9	2652.9
VC.4: Roof: Horizontal (213.47 ft², width 10.208 ft)	213.5	0.02	0.4	0.9	100	667.5	1024.3
VC.4: Roof: Horizontal (1671.09 ft², width 59.657 ft)	1671.1	0.02	0.4	0.9	100	5225.6	8018.7
VC.4: Roof: Horizontal (4028.14 ft², width 59.526 ft)	4028.1	0.02	0.4	0.9	100	12596.2	19328.9
VC.4: Roof: Horizontal (6427.05 ft², width 58.136 ft)	6427	0.02	0.4	0.9	100	20097.7	30840
VC.5: Below-grade Walls: North (A0°, 467.56 ft², width 38.964 ft)	467.6	0.11	0	0	0	3448.2	7931.4
VC.5: Below-grade Walls: West (A270°, 962.75 ft², width 80.229 ft)	962.8	0.11	0	0	0	7100.2	16331.4



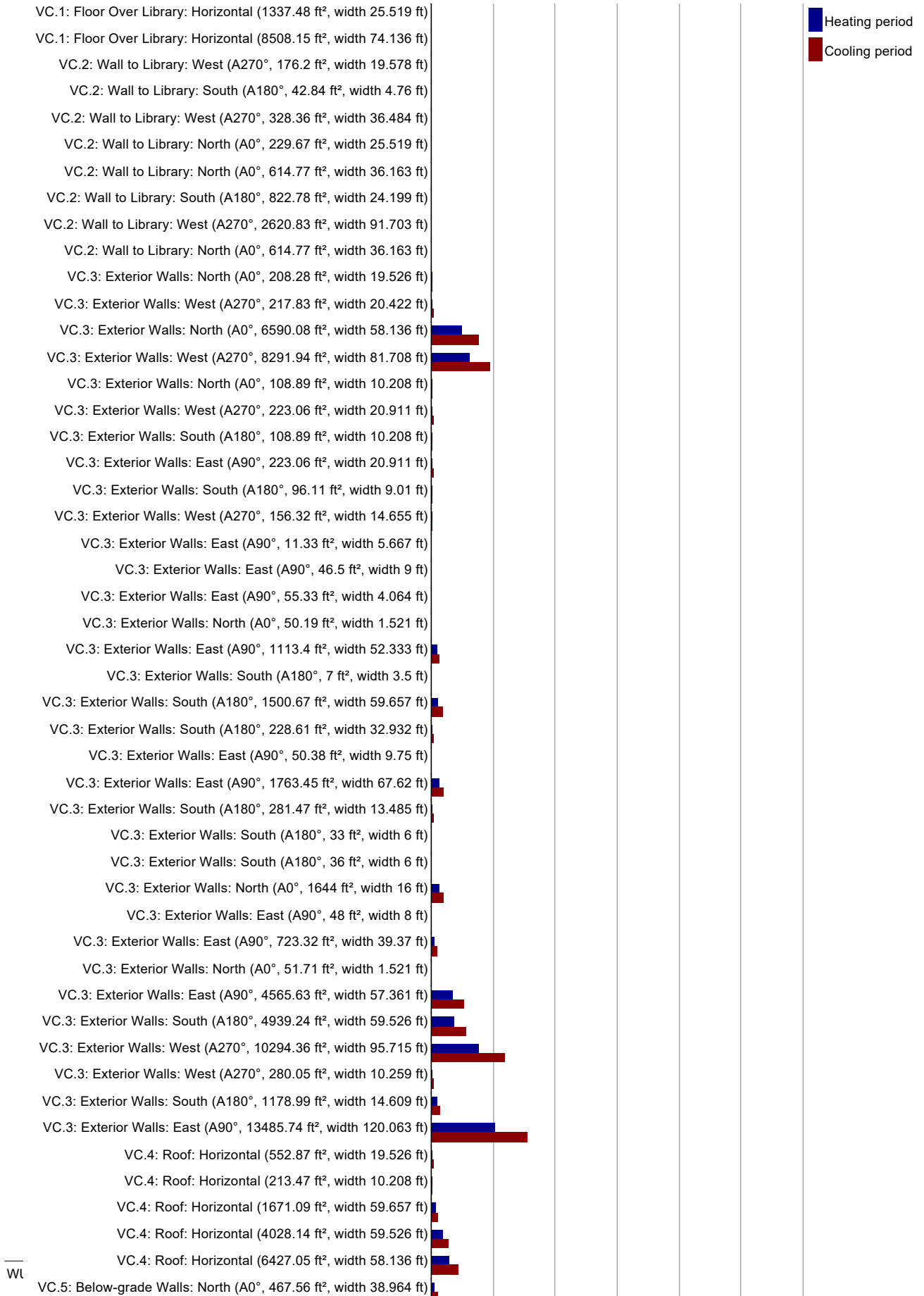
## Transmission heat losses - areas (continue)

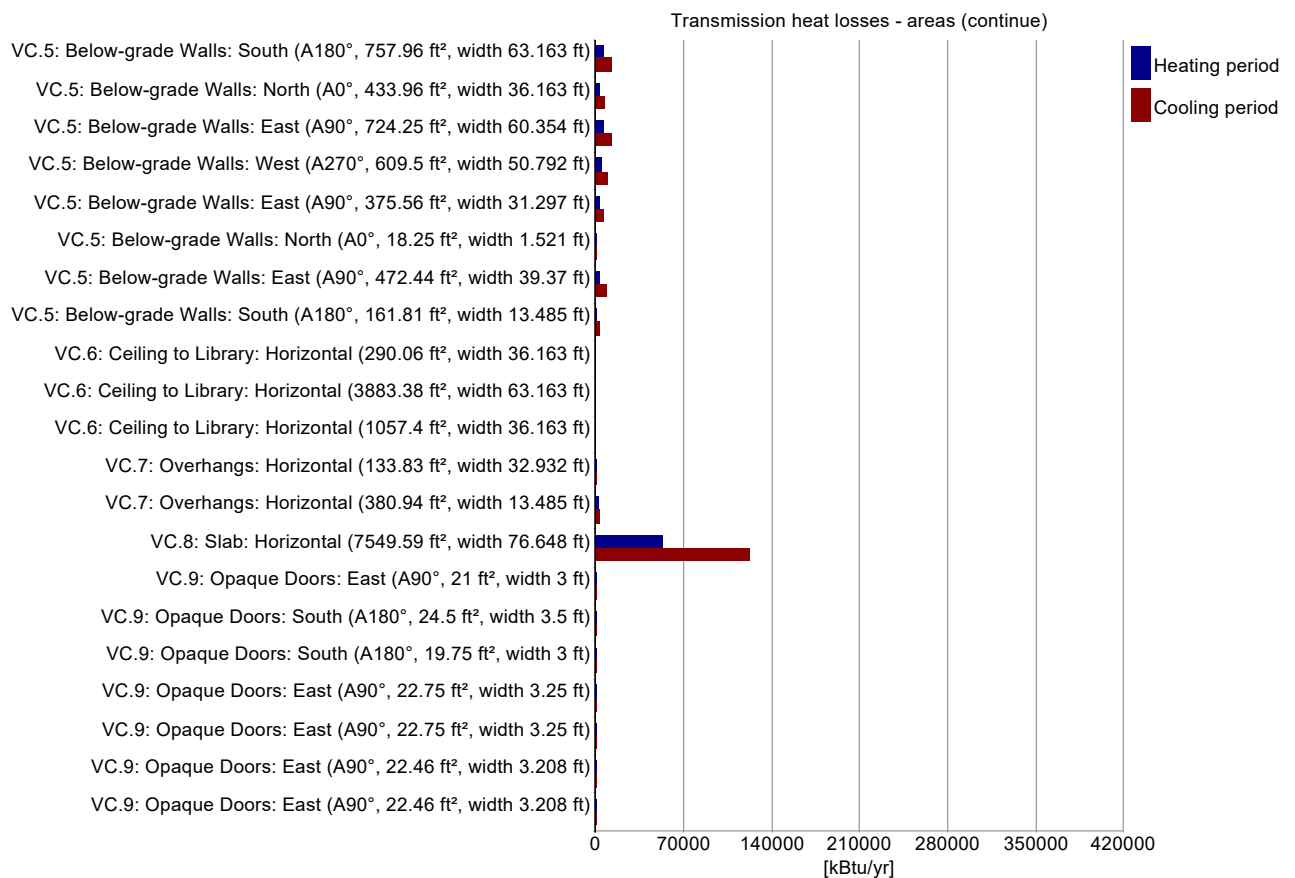
Name	Area [ft²]	Average U-value [Btu/hr ft² °F]	Absorption coefficient	Emission coefficient	Reduction factor shading [%]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.5: Below-grade Walls: South (A180°, 757.96 ft², width 63.163 ft)	758	0.11	0	0	0	5589.8	12857.4
VC.5: Below-grade Walls: North (A0°, 433.96 ft², width 36.163 ft)	434	0.11	0	0	0	3200.4	7361.3
VC.5: Below-grade Walls: East (A90°, 724.25 ft², width 60.354 ft)	724.3	0.11	0	0	0	5341.2	12285.6
VC.5: Below-grade Walls: West (A270°, 609.5 ft², width 50.792 ft)	609.5	0.11	0	0	0	4495	10339.1
VC.5: Below-grade Walls: East (A90°, 375.56 ft², width 31.297 ft)	375.6	0.11	0	0	0	2769.7	6370.8
VC.5: Below-grade Walls: North (A0°, 18.25 ft², width 1.521 ft)	18.3	0.11	0	0	0	134.6	309.6
VC.5: Below-grade Walls: East (A90°, 472.44 ft², width 39.37 ft)	472.4	0.11	0	0	0	3484.2	8014.1
VC.5: Below-grade Walls: South (A180°, 161.81 ft², width 13.485 ft)	161.8	0.11	0	0	0	1193.4	2744.9
VC.6: Ceiling to Library: Horizontal (290.06 ft², width 36.163 ft)	290.1	0.035	0	0	0	0	0
VC.6: Ceiling to Library: Horizontal (3883.38 ft², width 63.163 ft)	3883.4	0.035	0	0	0	0	0
VC.6: Ceiling to Library: Horizontal (1057.4 ft², width 36.163 ft)	1057.4	0.035	0	0	0	0	0
VC.7: Overhangs: Horizontal (133.83 ft², width 32.932 ft)	133.8	0.034	0.4	0.9	100	711.1	1091.2
VC.7: Overhangs: Horizontal (380.94 ft², width 13.485 ft)	380.9	0.034	0.4	0.9	100	2024.1	3106
VC.8: Slab: Horizontal (7549.59 ft², width 76.648 ft)	7549.6	0.106	0	0	0	53404.1	122837.1
VC.9: Opaque Doors: East (A90°, 21 ft², width 3 ft)	21	0.143	0.4	0.9	100	468.9	719.5
VC.9: Opaque Doors: South (A180°, 24.5 ft², width 3.5 ft)	24.5	0.143	0.4	0.9	100	547	839.4
VC.9: Opaque Doors: South (A180°, 19.75 ft², width 3 ft)	19.8	0.143	0.4	0.9	100	441	676.6
VC.9: Opaque Doors: East (A90°, 22.75 ft², width 3.25 ft)	22.8	0.143	0.4	0.9	100	507.9	779.4
VC.9: Opaque Doors: East (A90°, 22.75 ft², width 3.25 ft)	22.8	0.143	0.4	0.9	100	507.9	779.4
VC.9: Opaque Doors: East (A90°, 22.46 ft², width 3.208 ft)	22.5	0.143	0.4	0.9	100	501.4	769.4
VC.9: Opaque Doors: East (A90°, 22.46 ft², width 3.208 ft)	22.5	0.143	0.4	0.9	100	501.4	769.4

## Degree hours [kFh/a]

	Heating	Cooling
Ambient heating	86.5	132.8
Ground heating	37.2	85.6

Transmission heat losses - areas





## THERMAL BRIDGES

### Transmission heat losses - thermal bridges

Name	Length [ft]	Psi-value [Btu/hr ft °F]	Transmission losses [kBtu/yr]	Transmission losses cooling [kBtu/yr]
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## WINDOWS

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.6	64.2	714.3	1,046.8	494.5	758.8
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	61.2	47.9	289.5	407.1	246	377.5
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	61.6	48.7	290.6	409.7	246	377.5
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	68.5	58.1	711	1,026.2	491.6	754.4
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	61.2	47.9	289.5	407.1	246	377.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	68.8	58.8	711.7	1,030.7	491.6	754.4
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	64.6	50.9	407.5	573.6	317	486.5
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	70.3	61.6	720.7	1,052.5	491.6	754.4
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: North (A0°, 18 ft², width 4 ft)	1	90	0.225	0.4	45.8	43.4	196.2	348	630.8	967.9
VC.11: Res Windows: North (A0°, 13 ft², width 2 ft)	1	90	0.244	0.4	50.9	47.7	159.3	279.1	494.5	758.8
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	31.8	31.6	43.3	80.4	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	32.2	31.3	100.8	183.5	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	33.4	33	45.8	84.6	246	377.5
VC.11: Res Windows: North (A0°, 8 ft², width 4 ft)	1	90	0.254	0.4	24.7	24.3	45.3	83.3	317	486.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	55.5	52.7	78.9	140.2	246	377.5
VC.11: Res Windows: North (A0°, 13 ft², width 2 ft)	1	90	0.244	0.4	26.3	25.5	79.5	144.1	494.5	758.8
VC.11: Res Windows: North (A0°, 13 ft², width 2 ft)	1	90	0.244	0.4	42	39.8	129.8	230	494.5	758.8
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	51.1	48.4	164.4	291.2	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	35.6	34.9	49	90	246	377.5
VC.11: Res Windows: North (A0°, 13 ft², width 2 ft)	1	90	0.244	0.4	45.8	43.1	142.3	250.8	494.5	758.8
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	43.7	41.5	139.8	248.6	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	38.7	37.1	122.8	220.2	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	40.6	39.3	56.6	102.6	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	42.8	41.3	60	108.2	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	49.7	47.1	159.4	282.9	491.6	754.4
VC.11: Res Windows: North (A0°, 13 ft², width 2 ft)	1	90	0.244	0.4	20.9	20.6	62.6	114.7	494.5	758.8
VC.11: Res Windows: North (A0°, 8 ft², width 4 ft)	1	90	0.254	0.4	21.3	21.1	38.7	71.7	317	486.5
VC.11: Res Windows: North (A0°, 8 ft², width 4 ft)	1	90	0.254	0.4	40.9	39.7	76.3	138.1	317	486.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	60.6	57.2	195	345.1	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	58.8	55.2	190.5	334.8	491.6	754.4
VC.11: Res Windows: North (A0°, 18 ft², width 4 ft)	1	90	0.225	0.4	41.6	39.7	177	316	630.8	967.9
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	46.1	44.5	64.7	116.6	246	377.5

## Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: North (A0°, 13 ft², width 2 ft)	1	90	0.244	0.4	42.4	40.2	131.3	232.5	494.5	758.8
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	48.4	46.5	68.1	122.3	246	377.5
VC.11: Res Windows: North (A0°, 18 ft², width 4 ft)	1	90	0.225	0.4	16.3	15.9	68	123.8	630.8	967.9
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	55.8	52.9	178.7	317.8	491.6	754.4
VC.11: Res Windows: North (A0°, 18 ft², width 4 ft)	1	90	0.225	0.4	23	22.2	96.5	174.5	630.8	967.9
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	30.6	29.9	95.2	174.1	491.6	754.4
VC.11: Res Windows: North (A0°, 18 ft², width 4 ft)	1	90	0.225	0.4	42.3	40.3	180.3	321.4	630.8	967.9
VC.11: Res Windows: North (A0°, 8 ft², width 4 ft)	1	90	0.254	0.4	41.5	40.1	77.3	139.8	317	486.5
VC.11: Res Windows: North (A0°, 8 ft², width 4 ft)	1	90	0.254	0.4	42.9	41.4	80.3	144.8	317	486.5
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.5	434.5	246	377.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.2	491.6	754.4
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.5	434.5	246	377.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.2	491.6	754.4
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	587	317	486.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.8	317	486.5
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.4	1,055.7	1,539.6	630.8	967.9
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.7	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.7	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.5	630.8	967.9
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.7	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.5	630.8	967.9
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.5	630.8	967.9
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.4	246	377.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.4	1,055.7	1,539.6	630.8	967.9
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.7	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.2	491.6	754.4
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.2	491.6	754.4
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.4	246	377.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.2	491.6	754.4
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.5	434.5	246	377.5

## Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.2	491.6	754.4
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.5	494.5	758.8
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.2	491.6	754.4
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.2	491.6	754.4
VC.11: Res Windows: South (A180°, 5 ft², width 0.833 ft)	1	90	0.32	0.4	51	49.1	186.5	282.9	249	382.1
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.7	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.2	491.6	754.4
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 5 ft², width 0.833 ft)	1	90	0.32	0.4	51	49	186.4	282.6	249	382.1
VC.11: Res Windows: South (A180°, 5 ft², width 0.833 ft)	1	90	0.32	0.4	53.5	51	196.3	296.6	249	382.1
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 5 ft², width 0.833 ft)	1	90	0.32	0.4	53.5	51.1	196.1	296.6	249	382.1
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.7	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.2	491.6	754.4
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.7	1,123.2	491.6	754.4
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.5	630.8	967.9
VC.11: Res Windows: South (A180°, 5 ft², width 0.833 ft)	1	90	0.32	0.4	50.4	48.2	184.7	279.2	249	382.1
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.7	1,123.2	491.6	754.4
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.7	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.7	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.4	246	377.5
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.3	246	377.5
VC.11: Res Windows: South (A180°, 5 ft², width 0.833 ft)	1	90	0.32	0.4	51.1	49.1	186.8	283.1	249	382.1
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.7	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.4	246	377.5
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.8	1,123.2	491.6	754.4
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.7	1,123.1	491.6	754.4



### Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpen- dicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.4	246	377.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	65.4	770.7	1,123.1	491.6	754.4
VC.11: Res Windows: South (A180°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.3	51.5	308.4	434.4	246	377.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 13 ft², width 2 ft)	1	90	0.244	0.4	72.7	64.2	715.6	1,048.4	494.5	758.8
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.2	51.7	418.2	587.2	317	486.5
VC.11: Res Windows: South (A180°, 18 ft², width 4 ft)	1	90	0.225	0.4	77.1	67.3	1,055.7	1,539.4	630.8	967.9
VC.11: Res Windows: South (A180°, 8 ft², width 4 ft)	1	90	0.254	0.4	66.1	51.6	418.2	586.9	317	486.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	37.1	35.6	52.4	93.8	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	34	32	110.4	193.8	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	33	31.2	106.3	187.7	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	34.7	33.2	49	87.7	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	38	36.2	121.2	216.4	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	42.2	40.8	58.8	106.7	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	44.1	42.5	61.6	111.5	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	35.6	34.3	50.2	90.1	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	36.1	34.5	114.1	205.3	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	34.6	33.2	49	87.5	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	46.7	44.1	150.1	265.7	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	45.7	43.9	64.4	115.6	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	46.7	44.2	150.2	265.8	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	24.7	23.6	78.8	140.5	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.6	23.5	32.3	59.8	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	27.3	26.7	37.9	69.2	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	45.8	44	64.6	115.9	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.7	18.3	58.3	106.3	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	22.8	21.9	72.3	129.6	491.6	754.4
VC.11: Res Windows: North (A0°, 18 ft², width 4 ft)	1	90	0.225	0.4	53.2	50	229.7	404	630.8	967.9
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.2	17.9	56.8	103.9	491.6	754.4
VC.11: Res Windows: North (A0°, 8 ft², width 4 ft)	1	90	0.254	0.4	50.2	47.9	95.1	169.5	317	486.5
VC.11: Res Windows: North (A0°, 8 ft², width 4 ft)	1	90	0.254	0.4	48.8	46.6	92.1	164.4	317	486.5
VC.11: Res Windows: North (A0°, 18 ft², width 4 ft)	1	90	0.225	0.4	51.3	48.2	221	389.2	630.8	967.9
VC.11: Res Windows: North (A0°, 13 ft², width 2 ft)	1	90	0.244	0.4	57	53.2	178.6	312.2	494.5	758.8
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.1	23.9	33	61	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	22.3	21.4	70.6	126.7	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	26.9	26.4	37.3	68.2	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	22.7	21.8	71.9	129	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	19.1	18.7	59.8	108.9	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	22.2	21.4	70.5	126.6	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	24.3	23.3	77.6	138.4	491.6	754.4
VC.11: Res Windows: North (A0°, 18 ft², width 4 ft)	1	90	0.225	0.4	56.9	53.6	245	432.2	630.8	967.9

### Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpen- dicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.2	23.9	33.1	61.1	246	377.5
VC.11: Res Windows: North (A0°, 18 ft², width 4 ft)	1	90	0.225	0.4	61.1	57.7	261	463.5	630.8	967.9
VC.11: Res Windows: North (A0°, 13 ft², width 2 ft)	1	90	0.244	0.4	57.4	53.7	179.4	314.5	494.5	758.8
VC.11: Res Windows: North (A0°, 18 ft², width 4 ft)	1	90	0.225	0.4	60	56.3	258.8	455.2	630.8	967.9
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.1	23.9	33.1	61.1	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18	17.7	56	102.4	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18	17.7	56	102.5	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.1	17.8	56.4	103.1	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.1	17.7	56.4	103	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.1	23.9	33	61	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	27.1	26.5	37.5	68.4	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	27.3	26.7	37.8	68.9	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.1	23.9	33	61	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	28	27.3	38.9	70.8	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	32.9	31.7	46.4	83.2	246	377.5
VC.11: Res Windows: North (A0°, 8 ft², width 4 ft)	1	90	0.254	0.4	53.4	51	100.9	180.2	317	486.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.1	23.9	33	61	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	24.9	23.8	79.7	141.9	491.6	754.4
VC.11: Res Windows: North (A0°, 13 ft², width 2 ft)	1	90	0.244	0.4	54.7	51.2	171.1	299.8	494.5	758.8
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	28.3	27.6	39.3	71.5	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	32.5	31.3	45.7	82.2	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	27.1	26.5	37.6	68.6	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	30.3	28.6	98.2	172.8	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	29.8	28.1	96.2	169.5	491.6	754.4
VC.11: Res Windows: North (A0°, 8 ft², width 4 ft)	1	90	0.254	0.4	55.3	52.6	104.7	186.5	317	486.5
VC.11: Res Windows: North (A0°, 13 ft², width 2 ft)	1	90	0.244	0.4	51.9	48.6	162.5	284.5	494.5	758.8
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.1	17.7	56.2	102.9	491.6	754.4
VC.11: Res Windows: North (A0°, 8 ft², width 4 ft)	1	90	0.254	0.4	55.9	53.2	105.9	188.5	317	486.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.1	23.9	33	61	246	377.5
VC.11: Res Windows: South (A180°, 5 ft², width 0.833 ft)	1	90	0.32	0.4	56.4	53.2	207.6	312.4	249	382.1
VC.11: Res Windows: South (A180°, 5 ft², width 0.833 ft)	1	90	0.32	0.4	59.9	55.2	222.6	331.8	249	382.1
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	46.9	44.9	66.2	118.5	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	49.8	46.9	160.9	283.7	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	55.2	51.7	179.1	314.1	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	46.1	44.2	65	116.6	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	57.7	54.2	186.8	328.6	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	52.5	49.9	74.8	132.9	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	48.1	45.4	155	273.8	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	54.6	51.9	77.5	138	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	55.5	52.7	78.9	140.2	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	55.1	51.6	179	313.7	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	52.5	49.9	74.8	132.9	246	377.5
VC.11: Res Windows: South (A180°, 25 ft², width 4.167 ft)	1	90	0.218	0.4	54.3	47	1,036.1	1,505.8	849	1,302.8
VC.11: Res Windows: South (A180°, 6 ft², width 1 ft)	1	90	0.299	0.4	53.6	48.2	241.7	356.5	279	428.1
VC.11: Res Windows: South (A180°, 25 ft², width 4.167 ft)	1	90	0.218	0.4	54.9	48.4	1,042.2	1,524.7	849	1,302.8
VC.11: Res Windows: South (A180°, 6 ft², width 1 ft)	1	90	0.299	0.4	53.6	48.2	241.8	356.7	279	428.1
VC.11: Res Windows: South (A180°, 25 ft², width 4.167 ft)	1	90	0.218	0.4	55.5	49.7	1,046.2	1,541.1	849	1,302.8
VC.11: Res Windows: South (A180°, 6 ft², width 1 ft)	1	90	0.299	0.4	53.6	48.2	241.7	356.6	279	428.1
VC.11: Res Windows: South (A180°, 25 ft², width 4.167 ft)	1	90	0.218	0.4	55.8	50.2	1,048.4	1,547.8	849	1,302.8
VC.11: Res Windows: South (A180°, 6 ft², width 1 ft)	1	90	0.299	0.4	54.3	49.7	243	361.4	279	428.1

**Transmission heat losses - windows (continue)**

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: South (A180°, 25 ft², width 4.167 ft)	1	90	0.218	0.4	56.8	52.2	1,059.3	1,576.3	849	1,302.8
VC.11: Res Windows: South (A180°, 6 ft², width 1 ft)	1	90	0.299	0.4	54.5	50	243.3	362.3	279	428.1
VC.11: Res Windows: South (A180°, 25 ft², width 4.167 ft)	1	90	0.218	0.4	58.4	55.3	1,076.9	1,621.5	849	1,302.8
VC.11: Res Windows: South (A180°, 6 ft², width 1 ft)	1	90	0.299	0.4	55.1	51.2	245.2	366.7	279	428.1
VC.11: Res Windows: South (A180°, 25 ft², width 4.167 ft)	1	90	0.218	0.4	62.2	59.2	1,144.5	1,725.5	849	1,302.8
VC.11: Res Windows: South (A180°, 6 ft², width 1 ft)	1	90	0.299	0.4	56.1	52.7	248.7	373.2	279	428.1
VC.11: Res Windows: South (A180°, 25 ft², width 4.167 ft)	1	90	0.218	0.4	73.6	67.8	1,373	2,042.6	849	1,302.8
VC.11: Res Windows: South (A180°, 6 ft², width 1 ft)	1	90	0.299	0.4	60.7	54.9	272.8	403.6	279	428.1
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	52	49.7	73.7	131.6	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	45	42.7	143.8	256.5	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	48.6	45.8	155.8	276.4	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	19.3	18.8	60.5	110	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.2	24	33.1	61.2	246	377.5
VC.11: Res Windows: North (A0°, 13 ft², width 2 ft)	1	90	0.244	0.4	37.6	35.9	115.4	205.9	494.5	758.8
VC.11: Res Windows: North (A0°, 18 ft², width 4 ft)	1	90	0.225	0.4	37.7	36.3	159.4	286.6	630.8	967.9
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	28.8	28.3	89.1	163.9	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	30.1	29.5	41.4	76	246	377.5
VC.11: Res Windows: North (A0°, 8 ft², width 4 ft)	1	90	0.254	0.4	34.2	33.3	63.3	115.3	317	486.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	43.6	41.3	140.2	248.4	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	37.7	36.2	53.2	95.4	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	21.9	21.1	69.4	124.8	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	26.9	26.4	37.3	68.1	246	377.5
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	22.1	21.3	69.9	125.6	491.6	754.4
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	26.7	26.2	37	67.6	246	377.5
VC.11: Res Windows: North (A0°, 6 ft², width 3 ft)	1	90	0.263	0.4	31.6	31.4	43	79.8	246	377.5
VC.11: Res Windows: North (A0°, 13 ft², width 2 ft)	1	90	0.244	0.4	40.8	38.8	126	223.7	494.5	758.8
VC.11: Res Windows: North (A0°, 8 ft², width 4 ft)	1	90	0.254	0.4	39.5	38.4	73.3	133.2	317	486.5
VC.11: Res Windows: North (A0°, 18 ft², width 4 ft)	1	90	0.225	0.4	39.3	37.7	166.6	298.6	630.8	967.9
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	29.3	28.8	90.9	166.9	491.6	754.4
VC.11: Res Windows: North (A0°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	41.9	39.9	133.7	238.3	491.6	754.4
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	67.3	64.1	567.6	996.1	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	64.2	63.9	378.7	685.9	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	60.8	57.1	229.6	399.6	317	4

### Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpen- dicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	43.7	44.2	156.5	287.2	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	65.8	68.3	519.7	973.3	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	61.9	66	345.1	661.1	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	55.8	55.4	202	366.7	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	75.7	76.2	611	1,120	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	72	75.2	407.7	768.9	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	68.3	67.7	247.5	448.8	317	486.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	76.5	78.8	456.3	848.7	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	69.6	70.6	186.6	343	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.2	64.9	177.1	321.4	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	71.4	72.2	431.4	792.4	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	54	48.9	155.3	266.1	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	58.4	53.5	374.4	647.5	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	68	68	183.5	334.9	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	74.5	75.7	447.5	826.4	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	56.5	58.2	150.5	278.6	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	64.8	69.2	377.5	718.4	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	49.6	49.8	300.1	549.6	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	43.5	45.2	114.7	214.5	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	21.3	22.6	125.7	236.1	491.6	754.4
VC.11: Res Windows: East (A90°, 11.67 ft², width 2 ft)	1	90	0.246	0.4	47.6	49.9	241.8	456.1	447.2	686.2
VC.11: Res Windows: East (A90°, 21.39 ft², width 3.667 ft)	1	90	0.222	0.4	50.2	51.8	475.5	882.3	739.6	1,134.9
VC.11: Res Windows: East (A90°, 11.67 ft², width 2 ft)	1	90	0.246	0.4	57.3	60.5	289.5	549.5	447.2	686.2
VC.11: Res Windows: East (A90°, 21.39 ft², width 3.667 ft)	1	90	0.222	0.4	59	60.4	561.3	1,036.4	739.6	1,134.9
VC.11: Res Windows: East (A90°, 11.67 ft², width 2 ft)	1	90	0.246	0.4	70	72.7	358.4	671.3	447.2	686.2
VC.11: Res Windows: East (A90°, 21.39 ft², width 3.667 ft)	1	90	0.222	0.4	75	75.7	718.5	1,318.6	739.6	1,134.9
VC.11: Res Windows: East (A90°, 11.67 ft², width 2 ft)	1	90	0.246	0.4	76.9	81.9	385.2	737.4	447.2	686.2
VC.11: Res Windows: East (A90°, 21.39 ft², width 3.667 ft)	1	90	0.222	0.4	82.6	85.6	774.6	1,451.6	739.6	1,134.9
VC.11: Res Windows: East (A90°, 11.67 ft², width 2 ft)	1	90	0.246	0.4	76.9	81.9	385.2	737.4	447.2	686.2
VC.11: Res Windows: East (A90°, 21.39 ft², width 3.667 ft)	1	90	0.222	0.4	82.6	85.6	774.8	1,451.8	739.6	1,134.9
VC.11: Res Windows: East (A90°, 11.67 ft², width 2 ft)	1	90	0.246	0.4	76.9	81.9	385.2	737.4	447.2	686.2
VC.11: Res Windows: East (A90°, 21.39 ft², width 3.667 ft)	1	90	0.222	0.4	82.6	85.6	774.8	1,451.8	739.6	1,134.9
VC.11: Res Windows: East (A90°, 11.67 ft², width 2 ft)	1	90	0.246	0.4	76.9	81.9	385.2	737.4	447.2	686.2
VC.11: Res Windows: East (A90°, 21.39 ft², width 3.667 ft)	1	90	0.222	0.4	82.6	85.6	774.7	1,451.7	739.6	1,134.9
VC.11: Res Windows: East (A90°, 11.67 ft², width 2 ft)	1	90	0.246	0.4	76.9	81.9	385.2	737.4	447.2	686.2
VC.11: Res Windows: East (A90°, 21.39 ft², width 3.667 ft)	1	90	0.222	0.4	82.6	85.6	774.7	1,451.7	739.6	1,134.9
VC.11: Res Windows: East (A90°, 11.67 ft², width 2 ft)	1	90	0.246	0.4	76.9	81.9	385.2	737.4	447.2	686.2
VC.11: Res Windows: East (A90°, 21.39 ft², width 3.667 ft)	1	90	0.222	0.4	82.6	85.6	774.7	1,451.7	739.6	1,134.9
VC.11: Res Windows: East (A90°, 11.67 ft², width 2 ft)	1	90	0.246	0.4	76.9	81.9	385.2	737.4	447.2	686.2
VC.11: Res Windows: East (A90°, 21.39 ft², width 3.667 ft)	1	90	0.222	0.4	82.6	85.6	774.7	1,451.7	739.6	1,134.9
VC.11: Res Windows: East (A90°, 11.67 ft², width 2 ft)	1	90	0.246	0.4	76.9	81.9	385.3	737.4	447.2	686.2
VC.11: Res Windows: East (A90°, 21.39 ft², width 3.667 ft)	1	90	0.222	0.4	82.6	85.6	774.7	1,451.7	739.6	1,134.9
VC.11: Res Windows: East (A90°, 11.67 ft², width 2 ft)	1	90	0.246	0.4	77	81.9	385.6	737.9	447.2	686.2
VC.11: Res Windows: East (A90°, 21.39 ft², width 3.667 ft)	1	90	0.222	0.4	82.7	85.7	776.3	1,454.4	739.6	1,134.9
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	61.4	64.1	477.5	908	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	59	63.3	323.4	629.6	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	53.8	54.1	190.9	353.3	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	74.7	76.9	591.4	1,104.8	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	69.5	73.7	388.6	741.7	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	65.5	66.3	234	430.4	317	486.5

## Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	79.2	81.2	630.7	1,170.9	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	75.1	79.6	420.6	801.7	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	71.4	72.2	255.5	469.1	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	79.3	81.3	631.8	1,172.7	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	75.1	79.7	420.9	802.2	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	71.5	72.3	255.9	469.8	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.6	84.2	646.7	1,207.4	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77	82	429.5	822.3	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	72.6	73.6	258.9	476.8	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.6	84.2	646.7	1,207.4	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.3	82.3	430.9	825.4	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.6	74.8	261.8	483.6	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.7	84.2	647.6	1,208.7	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.3	82.4	431.1	825.7	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.6	74.8	261.8	483.6	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.6	84.2	646.7	1,207.4	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.3	82.3	430.9	825.4	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.6	74.8	261.8	483.6	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.6	84.2	646.7	1,207.4	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.3	82.3	430.9	825.4	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.6	74.8	261.8	483.6	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.6	84.2	646.7	1,207.4	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.3	82.3	430.9	825.4	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.6	74.8	261.8	483.6	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	51.1	51.5	408.8	755.6	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	48.5	51.1	270.7	517.8	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	40.8	41.1	145.4	267.9	317	486.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	52	54.7	134.7	256.3	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	56.2	60.3	321.6	622.8	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	51.9	54.6	134.5	255.8	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	56	60.1	320.7	621.3	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	54.8	63.4	300.1	607.4	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	50.8	57.3	126.8	250.5	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	46.1	50.9	266.4	511.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	43.9	47.1	115.1	216.4	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	22.5	22.8	137.9	249.6	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.9	24.1	68.8	122.7	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	24	24	64.9	118.4	246	377.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	23.4	22	199.9	346.3	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	25	24.7	148.3	267.3	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	24.5	22.7	92.3	160.8	317	486.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	50.7	50.7	138.9	250	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	63.4	68.9	362.6	702.9	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	54.9	58.5	141.3	270.3	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	30.3	30.4	80.9	149.1	246	377.5
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	31.5	29.2	118.6	206.7	317	486.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	62	68.2	351.5	687.3	491.6	754.4

### Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpen- dicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	29.9	30.3	79.4	147.2	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	54.7	60.3	138.3	269.6	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	55.9	56.6	341.3	620.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	54.6	58	140.9	268.9	246	377.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	37.7	37.2	308.6	557.4	630.8	967.9
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	61.7	67.8	350.3	684	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	35.1	37.6	202.4	389.4	491.6	754.4
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	36.1	36.9	207.2	385.3	494.5	758.8
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	34.8	37.5	200.4	386.5	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	60.8	63.6	159.2	299.8	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	69.8	75.1	400.3	774.5	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	66.1	68	174.6	325.8	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	59.7	63.3	154.3	294	246	377.5
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	59.9	63.2	207.6	393.6	317	486.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	72.6	75.9	425.6	805	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	60.4	63.5	157.3	297.5	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	63.2	66.8	163.2	311.2	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	70.2	75	404.8	778.8	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	66.1	68	174.6	325.8	246	377.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	74.6	79.6	576.4	1,103.5	630.8	967.9
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	72.6	76	425.9	805.5	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75	79.1	438	831.4	491.6	754.4
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	69.1	76.1	374.7	737.4	494.5	758.8
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	76.3	81.6	440.5	846.3	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	69.9	73.2	182.4	344.6	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.2	82.5	466.7	878.1	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.5	74.3	192.2	357.3	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	71.9	73.8	190.6	354.5	246	377.5
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	71.2	73.7	250.1	468.1	317	486.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.6	82.8	469.5	882.8	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	71.6	73.7	189.1	352.8	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.1	74	191.2	355.5	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	76.7	81.6	444.4	850.4	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.5	74.3	192.2	357.3	246	377.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	78.9	82.8	616.6	1,167.1	630.8	967.9
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.6	82.8	469.5	882.8	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	78.9	82.2	465	875.3	491.6	754.4
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	74.6	81.2	408.6	796.6	494.5	758.8
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	78.5	82.1	461.3	871	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	70.1	73.4	182.9	345.4	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.7	468.6	881.3	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	71.9	73.8	190.6	354.5	246	377.5
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	71.2	73.7	250.1	468.1	317	486.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	71.6	73.7	189.1	352.8	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.3	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	77	81.9	446.4	853.8	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	78.9	82.8	616.6	1,167.1	630.8	967.9



## Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	78.9	82.2	465	875.3	491.6	754.4
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	74.6	81.2	408.7	796.8	494.5	758.8
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	78.5	82.1	461.3	871	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.7	468.8	881.7	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72	73.8	190.6	354.6	246	377.5
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.1	74.4	260	480.4	317	486.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	71.9	73.8	190.6	354.5	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.4	74.2	191.9	356.7	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.2	83.7	642.6	1,200.4	630.8	967.9
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.2	82.5	467	878.7	491.6	754.4
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77	82	428.8	821.9	494.5	758.8
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	78.9	82.2	465	875.3	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.7	468.8	881.7	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.2	74.5	260.4	481.2	317	486.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.1	74	191	355.2	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.4	74.2	191.9	356.7	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.2	83.8	643.1	1,201.2	630.8	967.9
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77	82.1	429	822.2	494.5	758.8
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.2	82.5	467	878.7	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.7	468.8	881.7	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.2	74.5	260.4	481.2	317	486.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.4	74.2	191.9	356.7	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.2	83.8	643.1	1,201.2	630.8	967.9
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77	82.1	429	822.2	494.5	758.8
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.2	83.8	643.1	1,201.2	630.8	967.9
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77	82.1	429	822.2	494.5	758.8
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5

## Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.7	468.8	881.7	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.2	74.5	260.4	481.2	317	486.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.4	74.2	191.9	356.7	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.2	83.8	643.1	1,201.2	630.8	967.9
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77	82.1	429	822.2	494.5	758.8
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.7	468.8	881.7	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.2	74.5	260.4	481.2	317	486.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.4	74.2	191.9	356.7	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.2	83.8	643.1	1,201.2	630.8	967.9
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77	82.1	429	822.2	494.5	758.8
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.7	468.8	881.7	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.2	74.5	260.4	481.2	317	486.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.4	74.2	191.9	356.7	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.2	83.8	643.1	1,201.2	630.8	967.9
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.3	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77	82.1	429	822.2	494.5	758.8
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.8	469	882	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.2	74.5	260.4	481.2	317	486.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.8	83	470.5	884.6	491.6	754.4

**Transmission heat losses - windows (continue)**

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpen- dicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.3	74.1	191.6	356.1	246	377.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.4	74.2	191.9	356.7	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.6	74.4	192.5	357.7	246	377.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.2	83.8	643.1	1,201.2	630.8	967.9
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.7	83	470.4	884.3	491.6	754.4
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77	82.1	429	822.2	494.5	758.8
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.4	82.6	467.9	880.2	491.6	754.4
VC.11: Res Windows: East (A90°, 40 ft², width 5 ft)	1	90	0.209	0.4	84	86.4	1,481.2	2,761.3	1,304.5	2,001.8
VC.11: Res Windows: East (A90°, 40 ft², width 5 ft)	1	90	0.209	0.4	84.4	86.8	1,489.7	2,775.6	1,304.5	2,001.8
VC.11: Res Windows: East (A90°, 40 ft², width 5 ft)	1	90	0.209	0.4	84.4	86.8	1,489.7	2,775.5	1,304.5	2,001.8
VC.11: Res Windows: East (A90°, 40 ft², width 5 ft)	1	90	0.209	0.4	84.1	86.5	1,482.8	2,763.9	1,304.5	2,001.8
VC.11: Res Windows: East (A90°, 40 ft², width 5 ft)	1	90	0.209	0.4	81.5	83	1,445	2,679.8	1,304.5	2,001.8
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.3	82.3	430.9	825.4	494.5	758.8
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.6	84.2	646.7	1,207.4	630.8	967.9
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.6	74.8	261.8	483.6	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.6	84.2	646.7	1,207.4	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.3	82.3	430.9	825.4	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.6	74.8	261.8	483.6	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.6	84.2	646.7	1,207.4	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.3	82.3	430.9	825.5	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.6	74.8	262	483.8	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.6	84.2	646.7	1,207.4	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.3	82.3	430.9	825.4	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.6	74.8	261.8	483.6	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.6	84.2	646.7	1,207.4	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.3	82.3	430.9	825.4	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.6	74.8	261.8	483.6	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.7	84.2	647.2	1,208	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.3	82.3	430.9	825.5	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.6	74.8	261.8	483.6	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.8	84.3	648.6	1,210.5	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.4	82.4	431.4	826.4	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.8	75	262.5	484.8	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.3	83.9	643.9	1,202.5	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.1	82.2	429.9	823.8	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.4	74.7	261.2	482.4	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.3	83.9	643.9	1,202.6	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.1	82.2	430	823.9	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.4	74.7	261.2	482.4	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.3	83.9	643.9	1,202.6	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.1	82.2	430	823.9	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.4	74.7	261.2	482.4	317	486.5

## Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.3	83.9	643.9	1,202.6	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.2	82.2	430	823.9	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.4	74.7	261.2	482.4	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.4	83.9	644.4	1,203.3	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.2	82.2	430.1	824.1	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.4	74.7	261.2	482.5	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.4	83.9	644.4	1,203.3	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.2	82.2	430.1	824.2	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.4	74.7	261.2	482.4	317	486.5
VC.11: Res Windows: East (A90°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.5	84	645.3	1,204.9	630.8	967.9
VC.11: Res Windows: East (A90°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.2	82.3	430.4	824.7	494.5	758.8
VC.11: Res Windows: East (A90°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.5	74.7	261.4	482.8	317	486.5
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	70.1	71	186.9	345.4	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	76.8	79	455.5	851.9	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.5	74.3	192.1	357	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.7	468.6	881.4	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.5	74.3	192.1	357	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.7	468.6	881.4	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.5	74.3	192.1	357	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.7	468.6	881.4	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.5	74.3	192.1	357.1	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.7	468.7	881.4	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.5	74.3	192.1	357	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.7	468.7	881.4	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.5	74.3	192.1	357	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.8	468.9	881.8	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.5	74.3	192.1	357	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.8	468.9	881.9	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	70.5	72.5	186.4	347.3	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	76.9	80.4	451.7	852.8	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	70.5	72.5	186.4	347.3	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	76.9	80.4	451.7	852.8	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	70.5	72.5	186.4	347.3	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	76.9	80.4	451.7	852.8	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	70.5	72.5	186.4	347.3	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	76.9	80.4	451.7	852.8	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	70.5	72.5	186.4	347.3	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	76.9	80.4	451.8	853.1	491.6	754.4
VC.11: Res Windows: East (A90°, 6 ft², width 3 ft)	1	90	0.263	0.4	70.5	72.5	186.4	347.4	246	377.5
VC.11: Res Windows: East (A90°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	77	80.5	452.2	853.7	491.6	754.4
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	15.7	15.8	93.5	173.6	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	22.9	22.9	60.7	112.3	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	15.7	15.8	93.5	173.5	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	22.9	22.9	60.7	112.3	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	16	16.2	95.2	177.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	22.9	22.9	60.7	112.3	246	377.5

### Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpen- dicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	16.3	16.5	96.1	179.6	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	22.9	22.9	60.7	112.3	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	16.9	17.4	98.2	186.5	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	22.9	22.9	60.7	112.3	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	17.9	18	106	198.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.3	23.1	62.3	114.5	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	19.1	19.4	111.9	210.4	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.5	23.3	62.6	115.2	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	21.8	21.8	132.1	241.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.9	24	67.7	121.9	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	28.8	29.9	165.2	318	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	28.9	29.8	74.4	141.6	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	44.1	48.9	242.4	487.4	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	34.3	35.2	89.1	168.1	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	67.6	71.9	384.9	746.8	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	59.7	63.3	151.4	292.7	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.9	83.1	462.9	882.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.7	74.5	189.6	356.8	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	15.7	15.8	93.5	173.5	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	22.9	22.9	60.7	112.3	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	15.9	16.1	94.2	175.6	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	22.9	22.9	60.7	112.3	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	16.2	16.5	95.9	179.3	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	22.9	22.9	60.7	112.3	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	16.9	17.6	98.1	187.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23	23	60.8	112.8	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	17.8	18.6	102	196.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.1	23.1	60.9	113.1	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	19.6	20.4	114	216.4	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.8	23.7	63.2	116.7	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	25.4	27.4	142.3	280	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	26.6	27.9	68.1	130.4	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	34.5	36.8	199.1	380.8	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	30.6	30.7	81	150.2	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	48	45.6	298.4	529.5	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	44.7	42.2	123.7	219	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	60.9	57.1	379.3	671.9	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	51.8	45.5	150.4	254.2	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	72.8	74	429.8	804.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	65.6	65.3	174.7	321.7	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.9	83.1	462.9	882.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.8	74.6	189.7	357	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.2	16.6	116.1	201.3	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.3	23.2	66.8	119.4	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.4	16.9	116.8	203.4	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.3	23.2	66.8	119.4	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.4	16.9	116.8	203.4	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.3	23.2	66.8	119.4	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	19.1	18	119.1	211.3	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.4	23.3	66.9	119.9	246	377.5

### Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpen- dicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	20.2	19.3	124.3	222.8	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.6	23.5	67.3	120.6	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	21.2	20.8	129.4	234.5	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	25	24	68.1	122.5	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	28.3	29.5	161.9	312.4	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	28	28.5	73.4	137.2	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	41.2	46.1	224.7	455.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	31.9	32.1	83.4	156.4	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	62.9	67.5	357.5	694.9	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	55.4	57.8	142.6	271.6	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75.8	78.2	445.7	837	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	69	70.1	182.4	338.4	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.3	82.5	459.3	875.4	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	69.7	70.7	184.3	341.9	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.9	83.1	462.9	882.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.8	74.6	189.7	357	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.7	16.8	119.7	205.9	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.6	23.3	68	120.9	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.9	17.1	120.6	208.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.6	23.3	68	120.9	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.9	17.1	120.6	208.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.6	23.3	68	120.9	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	19.6	18.1	122.8	215.9	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.8	23.4	68.2	121.4	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	20.6	19.4	127.7	227	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.9	23.6	68.5	122.1	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	21.8	21	133.7	240.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	25.3	24.1	69.3	123.9	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	28.7	29.7	165.5	317.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	28.4	28.7	75	139.3	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	41.8	46.4	228.9	461.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	32.3	32.4	85	158.6	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	64.8	69.8	364.9	715.3	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	57.2	59.9	146.1	280.4	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	76.3	78.7	449	842.8	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	69.5	70.5	183.9	340.9	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.8	83	462.3	881.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	71.9	73.7	187.3	352.8	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.9	83.1	462.9	882.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.8	74.6	189.7	357	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	25.2	19.4	175.8	277.9	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	29.4	24.7	86.9	144	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	25.2	19.5	176	278.3	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	29.4	24.7	86.9	144	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	35.6	26.5	254.2	393.5	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	37.1	29.1	114.3	181.9	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	35.7	26.6	254.4	393.8	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	37.1	29.1	114.3	181.9	246	377.5



## Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	35.7	26.6	254.4	393.8	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	37.1	29.1	114.3	181.9	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	60.8	57.8	383.1	671.7	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	57.1	53.5	160.8	280	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	60.9	57.8	383.4	672	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	57.1	53.5	160.9	280.2	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	60.9	57.8	383.4	672.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	57.1	53.5	160.9	280.2	246	377.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	18.6	18.7	106.4	197.5	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	13.5	13.6	106.7	198.4	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	20.8	20.8	73.6	136.1	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	18.6	18.7	106.4	197.5	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	15	14.1	124.7	220.5	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	21.7	21	78.4	141.7	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	18.8	18.9	107.1	199.5	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	13.7	13.9	107.7	201.6	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	20.8	20.8	73.6	136.1	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	18.8	18.9	107.1	199.5	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	15.2	14.4	125.4	223.2	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	21.7	21	78.4	141.7	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	19	19.2	108.1	201.7	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	14.1	14.4	110.6	207.6	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	20.8	20.8	73.6	136.1	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	19	19.2	108.1	201.7	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	15.4	14.7	126.9	226.4	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	21.7	21	78.4	141.7	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	19	19.2	108.3	202	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	14.2	14.6	111.2	209.1	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	20.8	20.8	73.7	136.3	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	19.7	20.2	111	209.4	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	15.5	16.3	118.2	227.6	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	20.8	20.8	73.6	136.2	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	21	21.6	118.3	223.6	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	17.1	17.5	133.2	251.2	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	21.8	21.7	77.4	142.5	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	22.2	22.3	126.6	236.2	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	19.2	18.8	155	283.2	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	22	22	78.2	144.2	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	24.8	24	145.5	263.1	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	23.5	21.4	200.3	345.8	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	24.7	23	91.6	161.5	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	32.4	32.1	186	344.7	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	32.2	29.5	270.5	474.8	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	31.6	29.2	117.6	207	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	44.2	46.9	242.2	469.9	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	47.8	49.3	372.2	704.1	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	37.7	34.6	141.4	246.4	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	66.2	71.8	356.7	703.6	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	69.8	72.9	538.1	1,028	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	61.5	63.5	212.5	402.2	317	486.5

### Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpen- dicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.4	82.4	423.4	822.7	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.8	84.4	636.9	1,205	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.8	75	258.1	482.7	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	19.7	20.3	110.2	209.1	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	16.1	15.7	129.9	237.1	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	21.8	21.2	78.6	142.4	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	20.4	21.1	113.6	216.9	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	17.3	17.2	137.6	254.1	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	21.9	21.3	79	143.3	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	21.8	22.6	121.7	231.3	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	18.9	19	150.9	278.1	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	22.6	21.9	81.5	147.7	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	27.7	30.6	146	294.9	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	26.2	27.9	195.4	385.1	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	25.6	26.5	88.5	167.5	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	38	42.6	198	404	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	40.3	45	292.8	593.2	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	30.4	30.5	106.3	198.7	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	57.4	61.5	313.7	609.8	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	63.3	67.4	482.2	931.7	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	54.9	57	189.4	359.3	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	69.1	71.6	388	734.5	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	72.7	72.5	582.6	1,070.4	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	65.7	64.5	236.5	429.4	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	74.3	78.4	412.1	789.9	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	79.2	81	623.2	1,165.6	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	70.4	70.8	250.2	460.6	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.4	82.4	423.4	822.7	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.8	84.4	636.9	1,205	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.8	75	258.1	482.7	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	35.3	28.3	233.9	375.2	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	37.5	27.4	360.6	552.8	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4										

## Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	72.7	73.9	254	475.2	317	486.5
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	77.4	82.4	423.3	822.4	494.5	758.8
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.8	84.4	636.9	1,205	630.8	967.9
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	73.7	74.9	257.7	482	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	14.1	14.4	109.5	206.9	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	19.2	19.6	108.5	204.3	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	20.9	21	73.8	136.8	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	14.1	14.4	109.6	207.1	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	19.2	19.6	108.6	204.3	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	20.9	21	73.9	137	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	14.6	14.9	113	214.5	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	19.7	20	110.6	209	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	21.1	21.1	74.2	137.7	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	14.6	14.9	113.4	215.2	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	19.8	20.1	111.3	210.1	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	21.1	21.2	74.4	138.1	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	14.9	15.2	115.8	219.3	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	19.9	20.2	111.8	211.1	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	21.2	21.2	74.6	138.3	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	16.8	17.9	128.5	247.3	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	21.8	23	121.3	231.8	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	22.4	22.9	78.4	146.6	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	21.4	24.5	148.7	314.5	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	26.1	29.2	135.1	277.9	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	25.4	27.2	84.3	166.1	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	23.6	26.7	166.2	347.3	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	27.6	30.7	142.9	293	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	25.4	27.2	84.3	166.1	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	36	44.5	236.1	530.5	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	39.8	47.9	193.2	422.6	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	36.3	42.2	113.1	237.6	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	53.1	62.5	366.4	782.2	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	51.7	59.5	262.7	549.3	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	39.5	43.1	129.8	258	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	66.3	76.6	468.5	976.6	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	64.7	74.3	331.5	688.1	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	53.7	61.7	169.5	351.2	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	78.5	83.6	595.6	1,156.4	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	75.4	81.9	405.8	801.9	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	67.6	73.8	222.8	442	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	15	15.7	115.5	221.6	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	19.8	20.4	111.2	210.8	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	21	21.1	74.1	137.5	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	16.3	16.3	128.3	239.3	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	20.6	20.9	116.1	218.5	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	21.5	21.2	76.6	140.6	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	17.4	17.7	136.3	256	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	21.2	21.6	119.5	225.4	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	21.6	21.3	76.8	141	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	17.6	17.9	138.1	259.3	630.8	967.9

## Transmission heat losses - windows (continue)

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	21.8	22.3	122.7	231.6	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	22.2	22.1	78.9	145.2	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	21.3	21.2	173.1	313.8	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	24.2	25	137.5	257.5	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	24.4	23.9	88.7	159.8	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	28.2	29.1	216.7	414.9	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	30	32.1	161.3	318.7	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	28	28.7	96.6	182.9	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	31.1	32.2	236.9	457.7	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	32.3	34.5	173.9	343.7	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	29.2	29.3	102.6	191.3	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	45.7	50.3	335.7	673.4	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	45.8	52.3	234.1	487.1	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	41.2	45.6	133.9	269.7	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	63.1	66.5	481	928.9	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	57.6	62.1	310.7	612.2	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	47.1	46.6	167.1	307.8	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	77	79.6	597.3	1,133.9	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	70.4	75.7	381.8	748.4	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	60.9	63.4	209.1	398.3	317	486.5
VC.11: Res Windows: West (A270°, 18 ft², width 4 ft)	1	90	0.225	0.4	81.3	83.9	632.2	1,197	630.8	967.9
VC.11: Res Windows: West (A270°, 13 ft², width 2 ft)	1	90	0.244	0.4	76.8	81.9	420.1	816.8	494.5	758.8
VC.11: Res Windows: West (A270°, 8 ft², width 4 ft)	1	90	0.254	0.4	72.8	74	254.4	476	317	486.5
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.3	23.3	61.6	114.1	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	17.6	18.2	101.7	194.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.3	23.3	61.6	114.2	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	17.6	18.2	101.8	194.4	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.3	23.3	61.6	114.2	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.4	19.3	105.6	202.9	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.5	24.5	64.9	120.3	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	21.3	22.3	120.5	235.6	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	27.3	28.5	69.6	133.7	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	25.2	28.1	136	277.8	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	30.5	33.3	74.7	149.4	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	34.8	40.9	177.6	384	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	36	39.2	88.2	176.6	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	44	51.5	228.3	485.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	49.8	58.4	116.3	244.5	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	57.3	67.8	299	632.8	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	62.4	67.7	157	306.2	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	69.2	76.1	386.1	763.9	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	64.8	69.1	165.1	318	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	75.3	78.2	440.8	831.6	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	69.6	70.6	184.2	341.5	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	78.4	81.5	454.8	865.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.1	23.1	61.1	113.2	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	17.3	17.8	100.3	190.7	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.2	23.3	61.4	113.9	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	17.5	18.2	101.4	193.6	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.2	23.3	61.5	114	246	377.5

**Transmission heat losses - windows (continue)**

Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpen- dicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.3	19.2	105.3	202.4	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.2	24.1	64.4	118.7	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	19.7	20.1	115.8	217.8	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	25.4	25.9	66.9	124.6	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	21.5	22.8	124.5	237.8	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	29.1	31	72.5	142.7	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	29.8	33.1	158.5	329.3	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	32.1	33.1	81.5	157.5	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	36.9	40.7	196.3	407.4	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	46.6	53.7	108.5	228.4	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	52.2	60.7	272.7	576.7	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	54.9	58.8	138.3	269.3	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	66.5	72.8	371.6	734.3	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	63.3	67.4	161.2	310.4	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	74.6	77.5	435.8	823.3	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	71.8	73.6	186.9	351.9	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	78.8	82.1	456.3	870.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.1	23.1	61.1	113.2	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	17.2	17.7	99.6	189.5	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.5	23.3	62.6	115.1	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.1	18.2	106.9	199.7	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.5	23.3	62.7	115.5	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	19.1	19.5	112.4	211.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.2	24.1	64.4	118.7	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	19.8	20.1	116	218.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	26.3	26	71	129	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	23	23.1	138.4	253.9	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	30	31.1	76.5	147.1	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	31.1	33.2	171.2	343.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	32.2	33.2	81.9	158.2	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	37	40.8	196.8	408.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	46.8	53.8	109.3	229.5	246	377.5
VC.11: Res Windows: West (A27										

### Transmission heat losses - windows (continue)

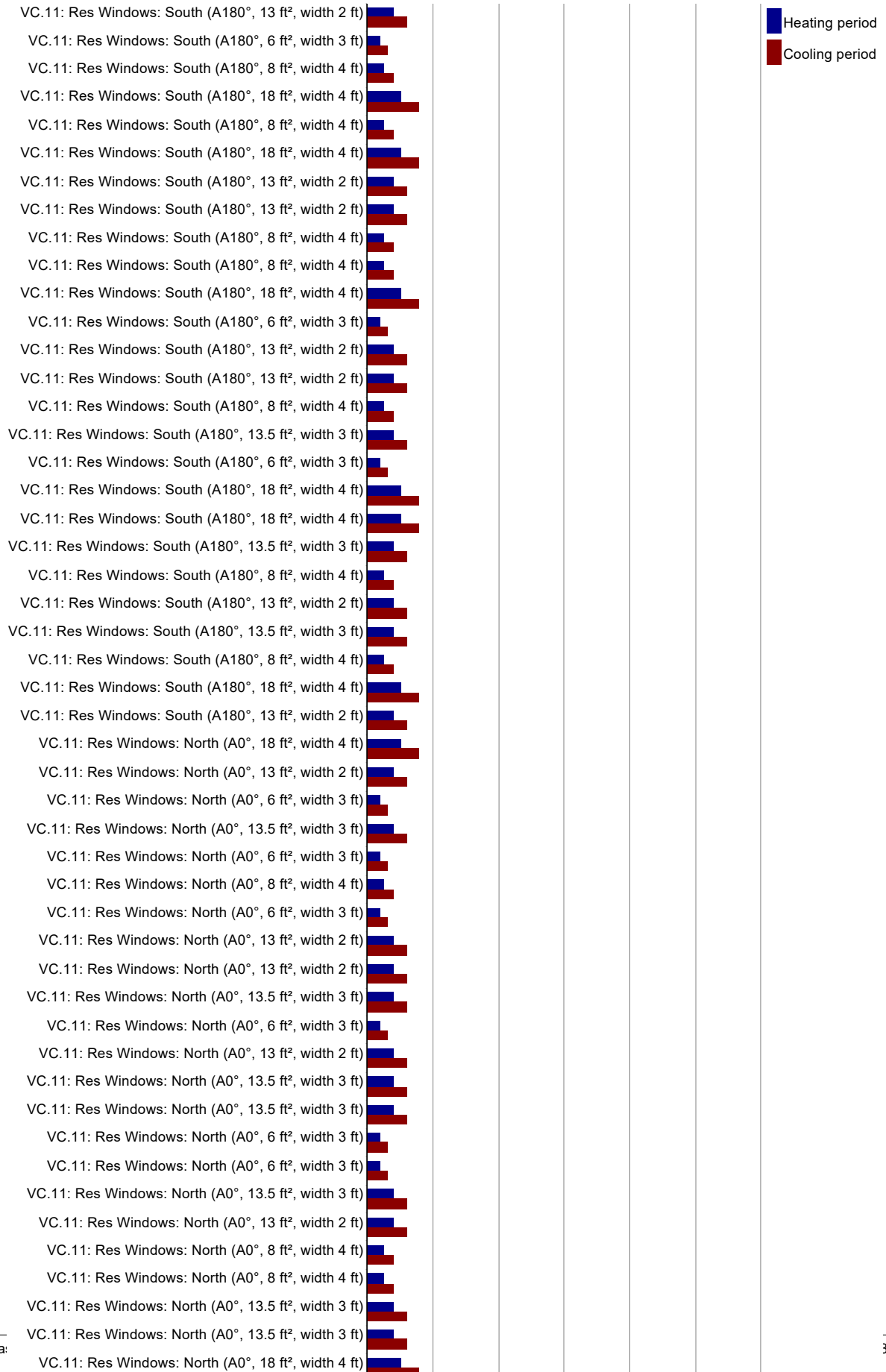
Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	26.3	29.1	142.5	290.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	28.9	30.3	73.2	141.5	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	28.4	31.1	154.8	313	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	39.4	44.7	94	193.2	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	42.3	48.5	224.4	466.5	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	45.1	45.9	117.8	221.1	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	60	65.7	332.3	662.6	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	59.4	63.3	150.3	291.5	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	73.4	77.6	419.1	810	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	72.1	74	187.6	353.7	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	79.5	82.8	460	877.6	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	52.5	63.9	117.1	257.6	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	59	74.9	283.6	651.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	41.7	49.4	95.2	204.6	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	45.7	57.2	219.2	504.4	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	31.6	34.8	76.5	155	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	36.5	44.6	179.5	403	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	31	34.2	74.7	151.9	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	26.9	31	138.4	296.5	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.6	24.9	63.7	120.4	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.6	19.1	106.6	205.7	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	24.4	24.8	63.3	119.7	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	18.4	18.9	105	202.9	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.2	23.1	61.5	113.7	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	16.3	16.2	97.7	180.1	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23.1	23.1	61.2	113.2	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	16.1	16.1	96.6	178.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	23	23	61	112.7	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	16	16	96	177.2	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	22.9	22.9	60.8	112.5	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	15.9	15.9	95.1	175.6	491.6	754.4
VC.11: Res Windows: West (A270°, 6 ft², width 3 ft)	1	90	0.263	0.4	22.9	22.9	60.8	112.4	246	377.5
VC.11: Res Windows: West (A270°, 13.5 ft², width 3 ft)	1	90	0.234	0.4	15.7	15.7	93.8	173.4		



## Transmission heat losses - windows (continue)

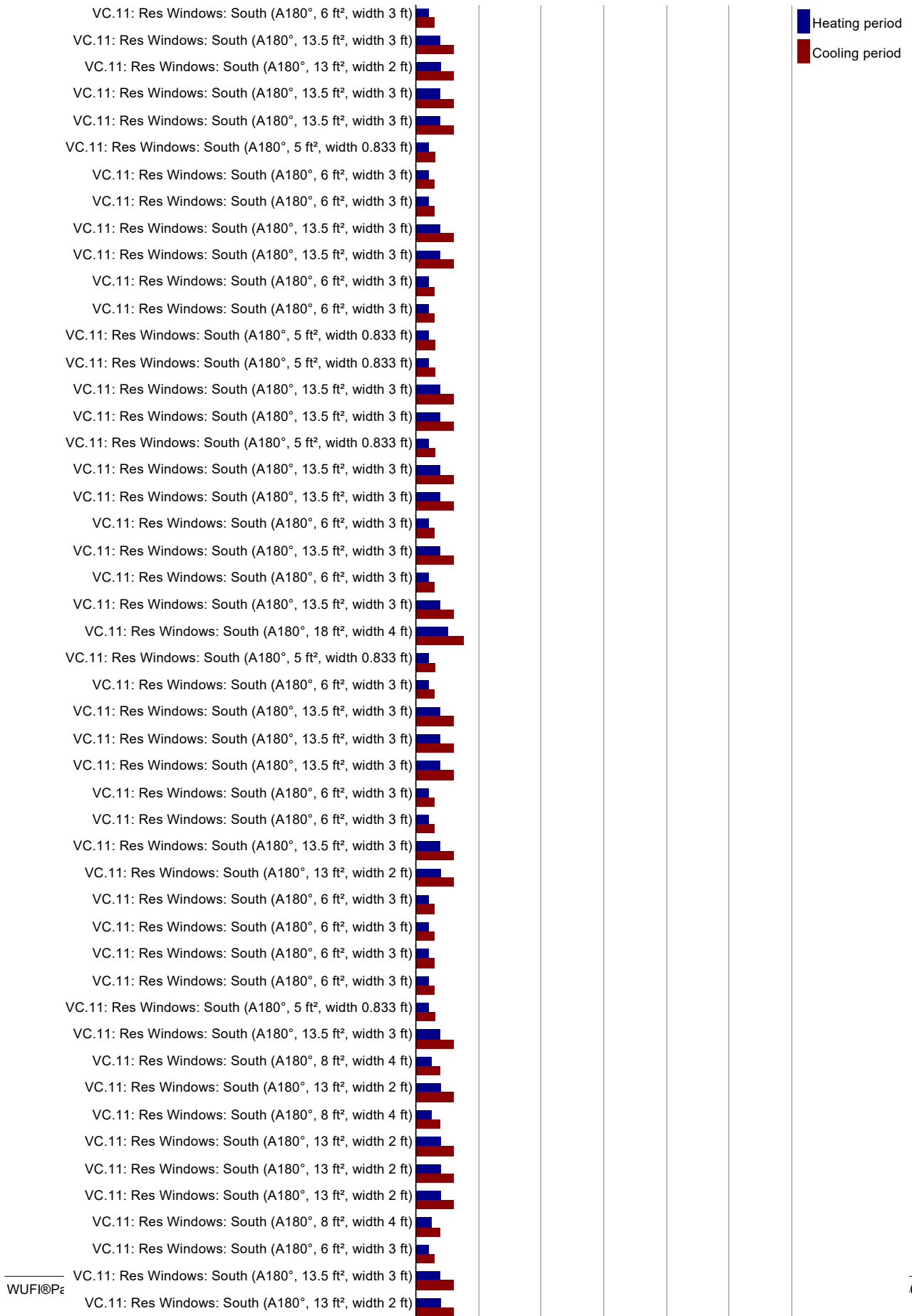
Name	Quantity	Inclination [°]	U-value total [Btu/hr ft² °F]	SHGC (perpendicular)	Reduction factor shading [%]	Reduction factor shading summer [%]	Solar gain heating [kBtu/yr]	Solar gain cooling [kBtu/yr]	Transmission losses heating [kBtu/yr]	Transmission losses cooling [kBtu/yr]
VC.10: SF Windows: South (A180°, 15 ft², width 2 ft)	1	90	0.227	0.4	46.3	42.9	517.3	771.1	530.5	814.1
VC.10: SF Windows: East (A90°, 41.67 ft², width 5 ft)	1	90	0.194	0.4	35.2	31.3	706.8	1,205.3	1,258.2	1,930.7
VC.10: SF Windows: South (A180°, 45 ft², width 6 ft)	1	90	0.192	0.4	40	30.8	1,431.6	1,999.2	1,344	2,062.3
VC.10: SF Windows: South (A180°, 21 ft², width 6 ft)	1	90	0.208	0.4	56.8	37.1	990.9	1,324.2	680	1,043.5
VC.10: SF Windows: South (A180°, 21 ft², width 3 ft)	1	90	0.21	0.4	59.4	39.4	1,030.3	1,383.4	688.3	1,056.1
VC.10: SF Windows: South (A180°, 21 ft², width 3 ft)	1	90	0.21	0.4	60.6	41.6	1,041.9	1,413.2	688.3	1,056.1
VC.10: SF Windows: East (A90°, 47.5 ft², width 5 ft)	1	90	0.192	0.4	42.5	33	1,045.1	1,658	1,422.8	2,183.2
VC.10: SF Windows: East (A90°, 28.5 ft², width 3 ft)	1	90	0.206	0.4	41.5	34	596.1	971.4	916.4	1,406.2
VC.10: SF Windows: East (A90°, 22.5 ft², width 3 ft)	1	90	0.209	0.4	41.8	34.4	474.4	773.7	733.9	1,126.2
VC.10: SF Windows: East (A90°, 37.5 ft², width 5 ft)	1	90	0.195	0.4	42.8	33.3	829.8	1,317.8	1,140.6	1,750.3
VC.10: SF Windows: East (A90°, 41.67 ft², width 5 ft)	1	90	0.194	0.4	35.4	31.5	711.1	1,212.6	1,258.2	1,930.7
VC.10: SF Windows: East (A90°, 39.58 ft², width 4.75 ft)	1	90	0.195	0.4	35.2	31.5	670.2	1,145.8	1,202.1	1,844.7
VC.10: SF Windows: East (A90°, 47.5 ft², width 5 ft)	1	90	0.192	0.4	32.8	29.1	752.8	1,279.8	1,422.8	2,183.2
VC.10: SF Windows: East (A90°, 45.13 ft², width 4.75 ft)	1	90	0.193	0.4	32.7	29.1	712	1,213.9	1,359.5	2,086.1
VC.10: SF Windows: East (A90°, 47.5 ft², width 5 ft)	1	90	0.192	0.4	32.5	28.8	747.2	1,270.3	1,422.8	2,183.2
VC.10: SF Windows: East (A90°, 38 ft², width 4 ft)	1	90	0.198	0.4	27.3	28.6	447.8	854.2	1,169.6	1,794.7
VC.10: SF Windows: East (A90°, 34.83 ft², width 3.667 ft)	1	90	0.2	0.4	27.8	29.6	412.2	796.9	1,085.2	1,665.2
VC.10: SF Windows: East (A90°, 19 ft², width 2 ft)	1	90	0.224	0.4	29.4	31.4	235.7	458.2	663.2	1,017.7
VC.10: SF Windows: East (A90°, 13.33 ft², width 2 ft)	1	90	0.229	0.4	36.9	40.5	207.2	404.1	475.2	729.3
VC.10: SF Windows: East (A90°, 24.44 ft², width 3.667 ft)	1	90	0.205	0.4	36.7	40.5	378.2	738.2	779.6	1,196.3
VC.10: SF Windows: East (A90°, 33.33 ft², width 4 ft)	1	90	0.199	0.4	30.8	31.6	450	845	1,034.1	1,586.8
VC.10: SF Windows: South (A180°, 7.5 ft², width 1 ft)	1	90	0.28	0.4	53.2	48.1	299.5	442.6	327.2	502

Transmission heat losses - windows

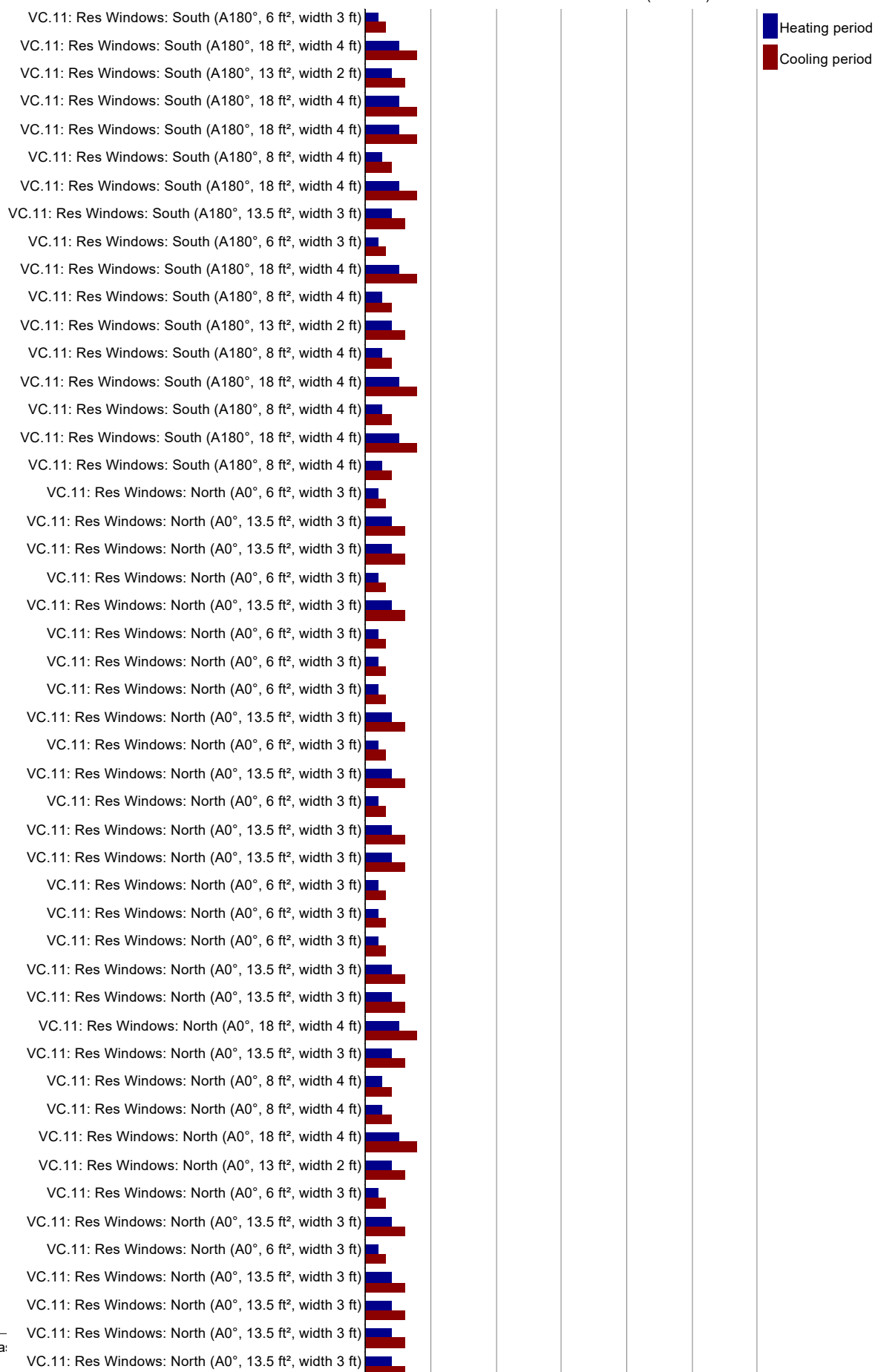




- Heating period
- Cooling period



Transmission heat losses - windows (continue)



Transmission heat losses - windows (continue)

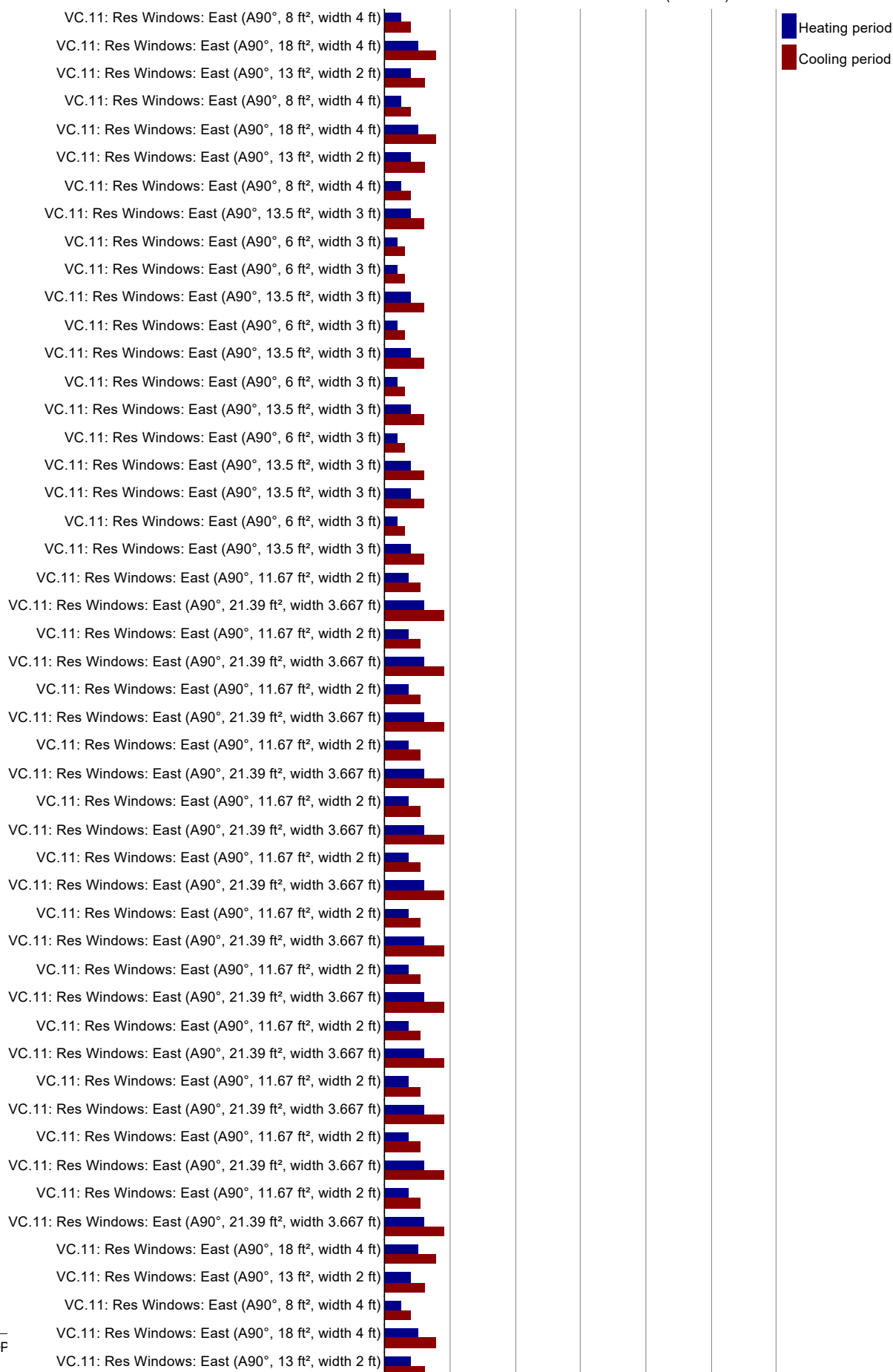




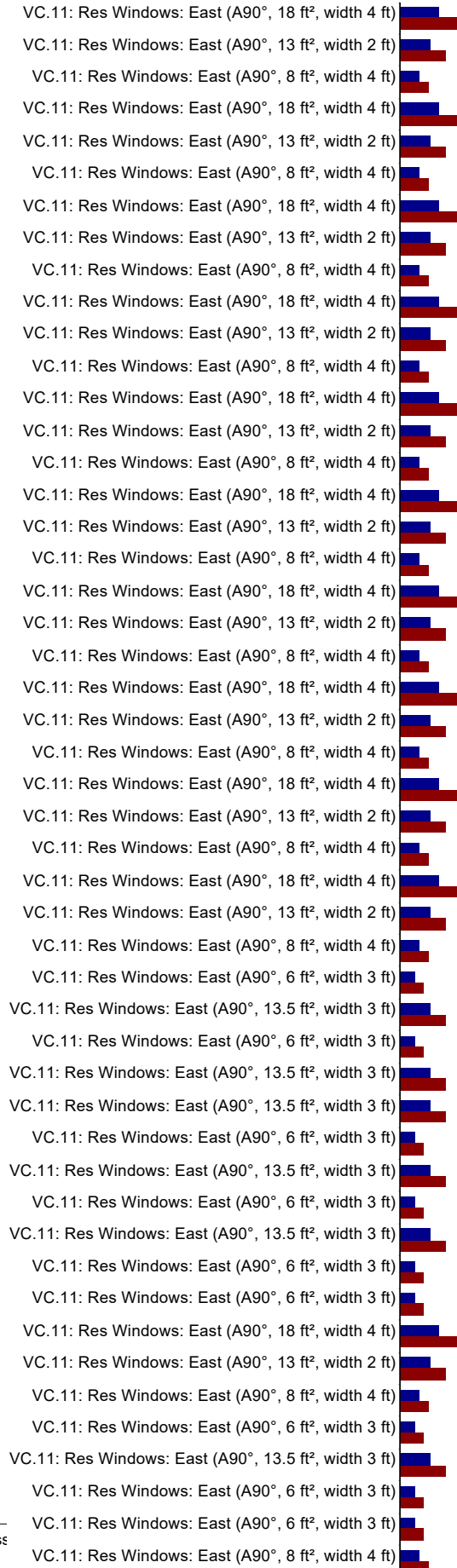
Transmission heat losses - windows (continue)



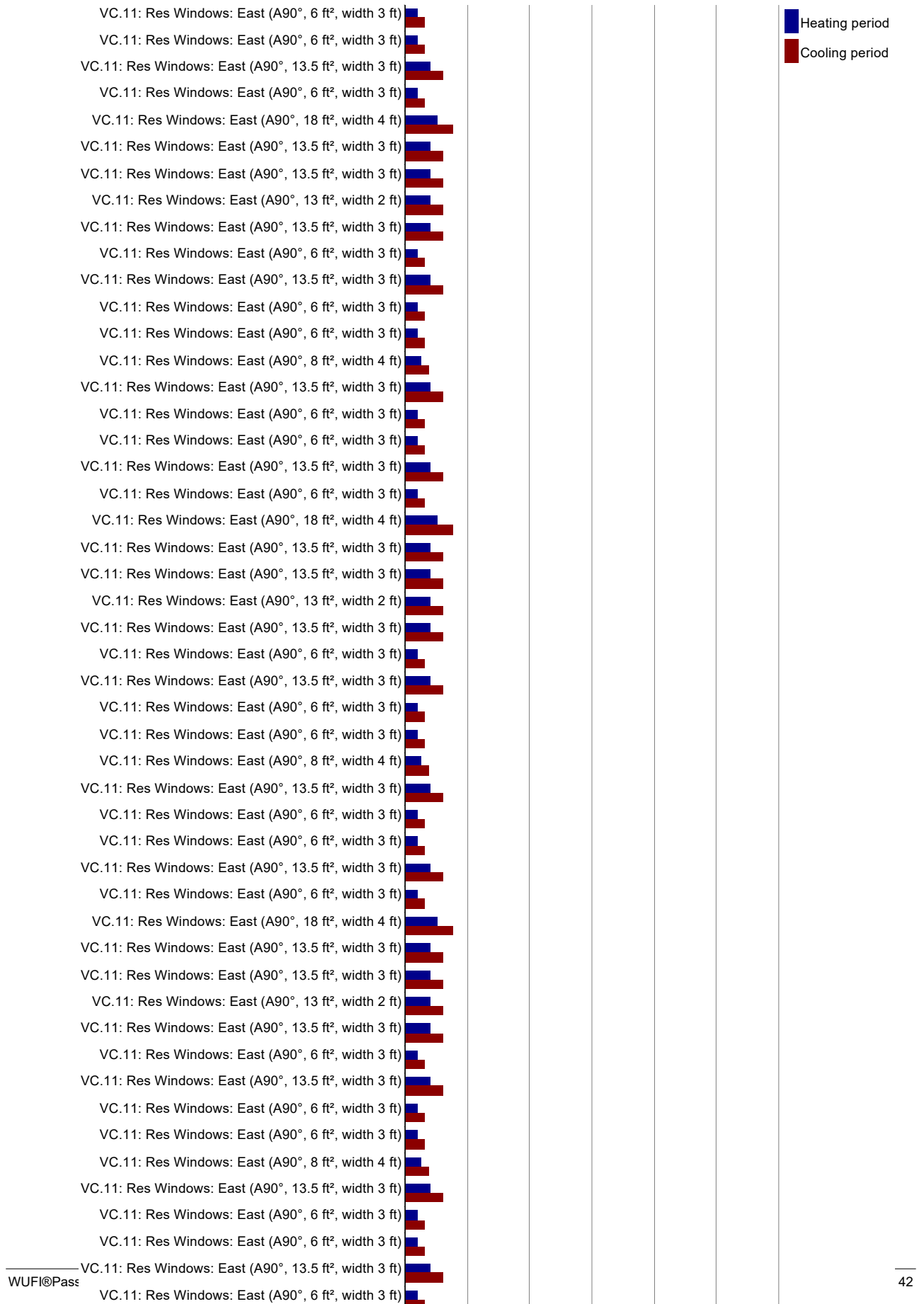
Transmission heat losses - windows (continue)



- Heating period
- Cooling period



- Heating period
- Cooling period



Transmission heat losses - windows (continue)

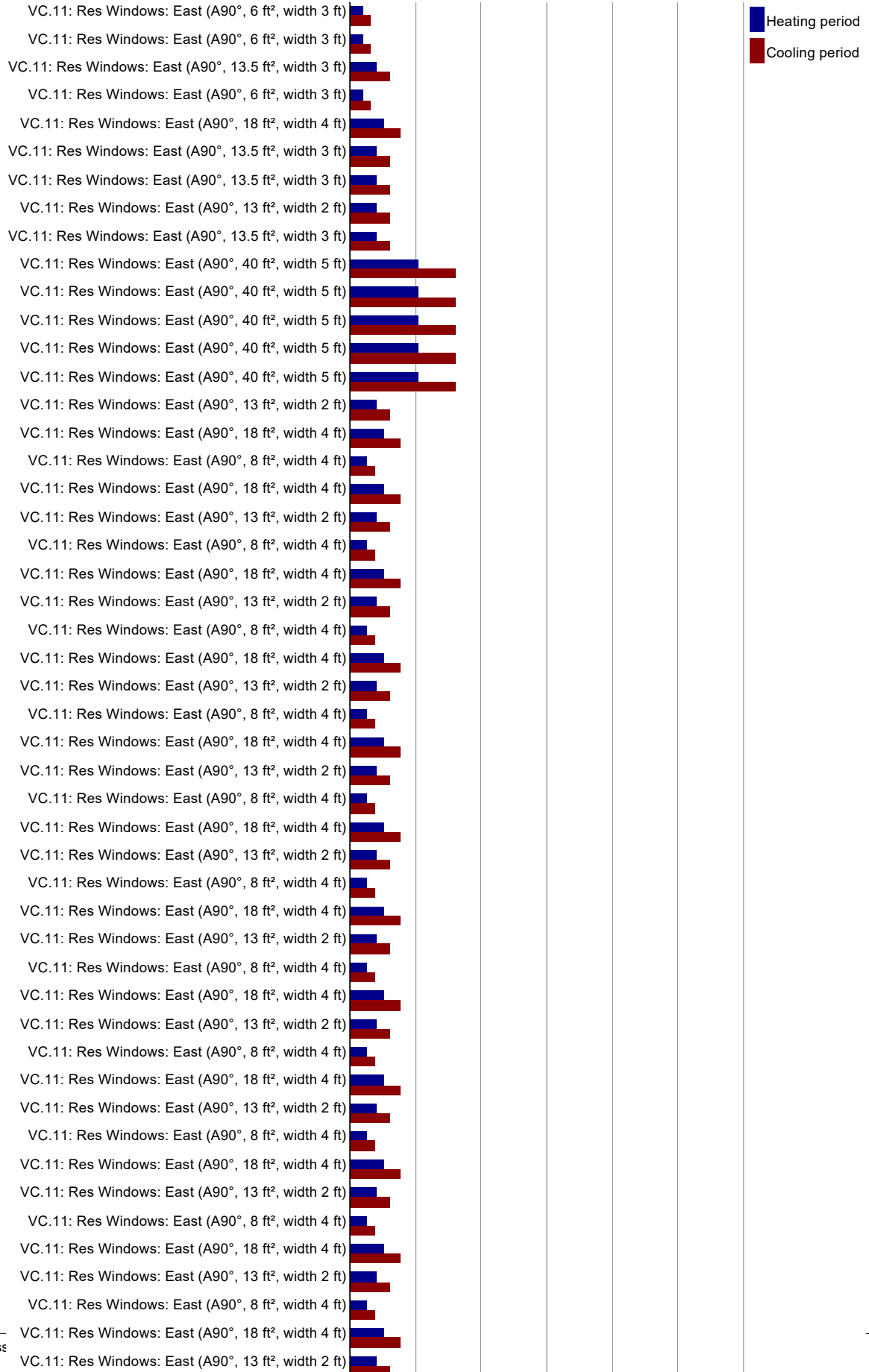


Transmission heat losses - windows (continue)

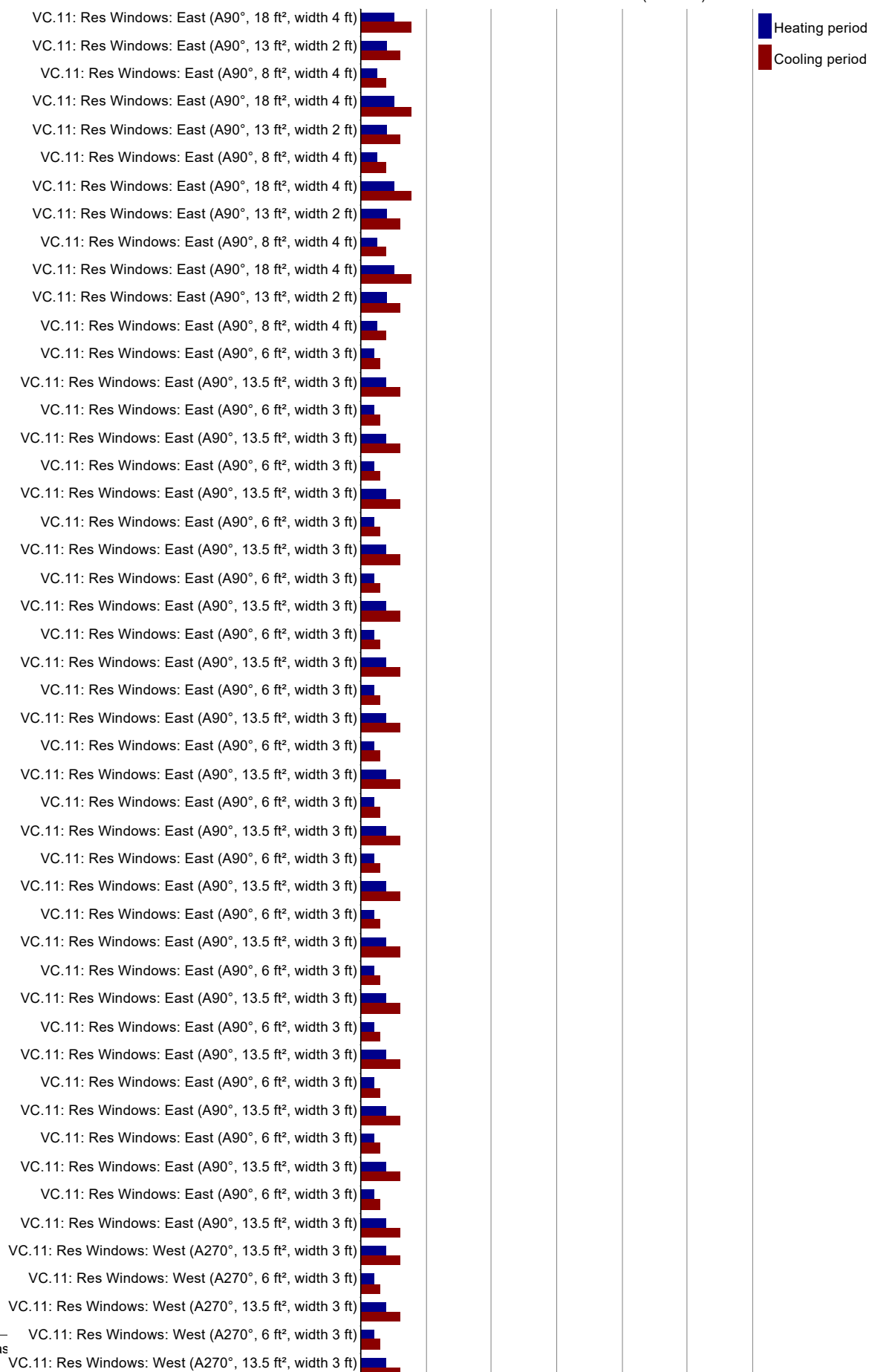




Transmission heat losses - windows (continue)

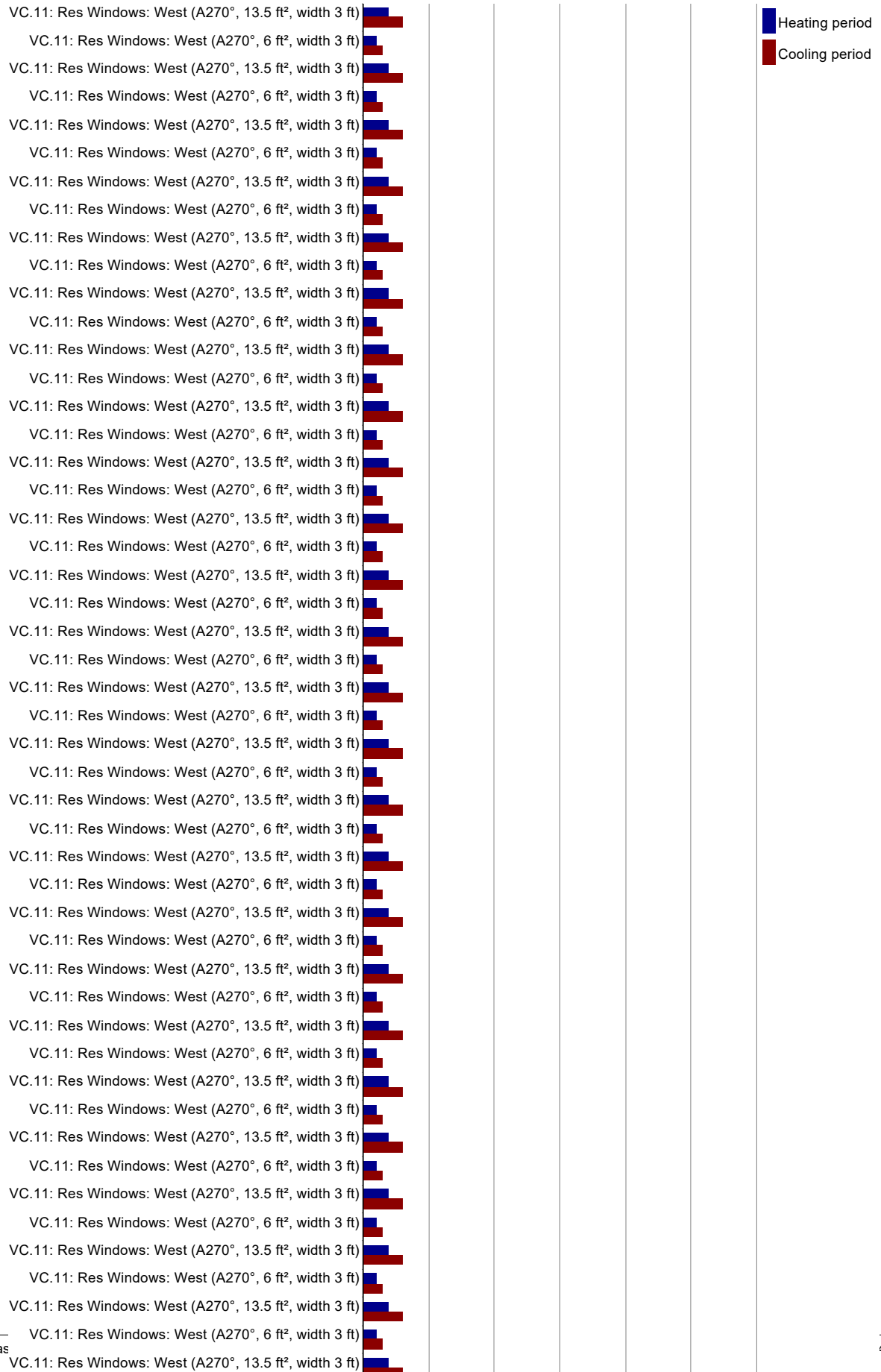


Transmission heat losses - windows (continue)

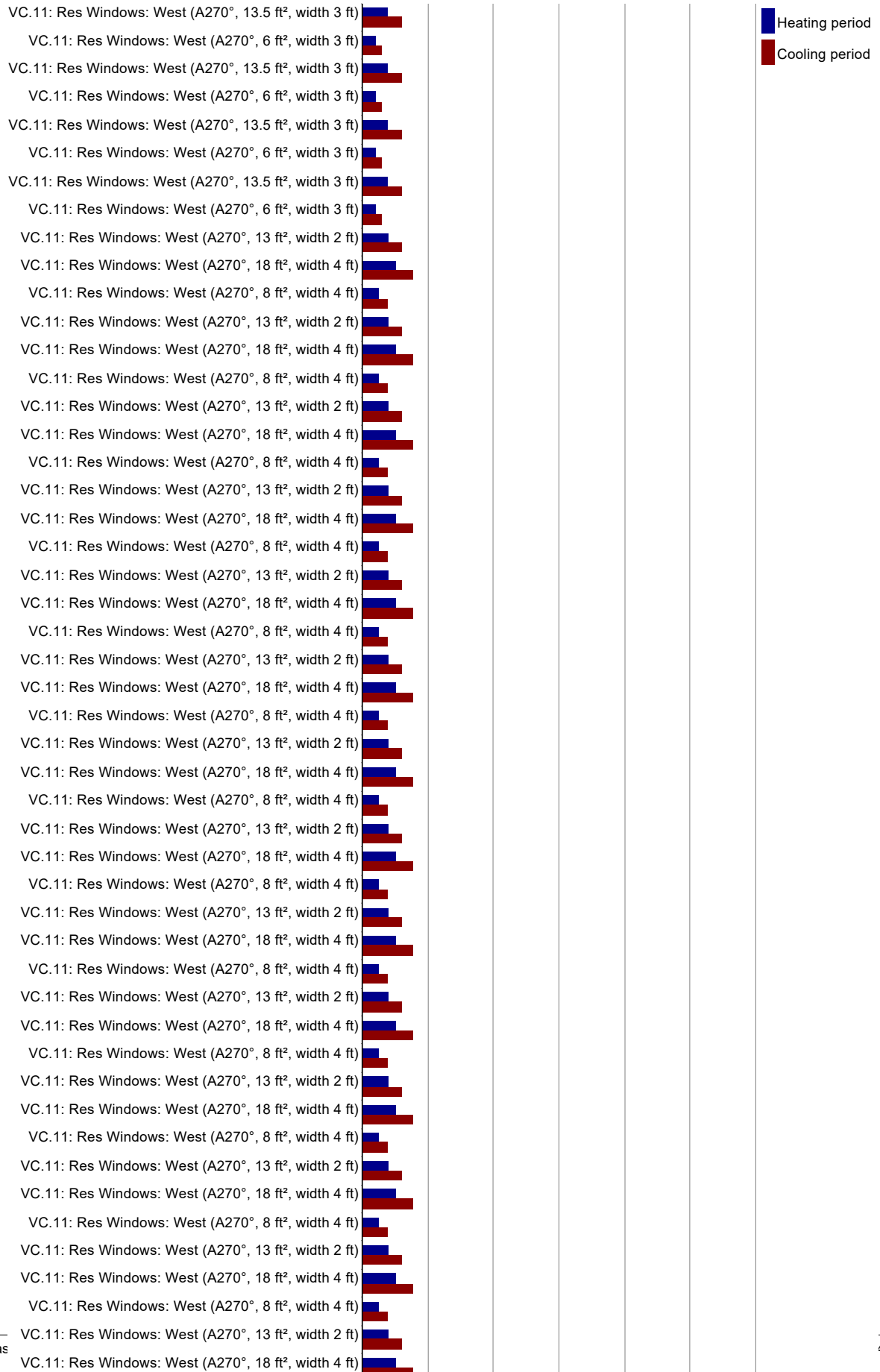


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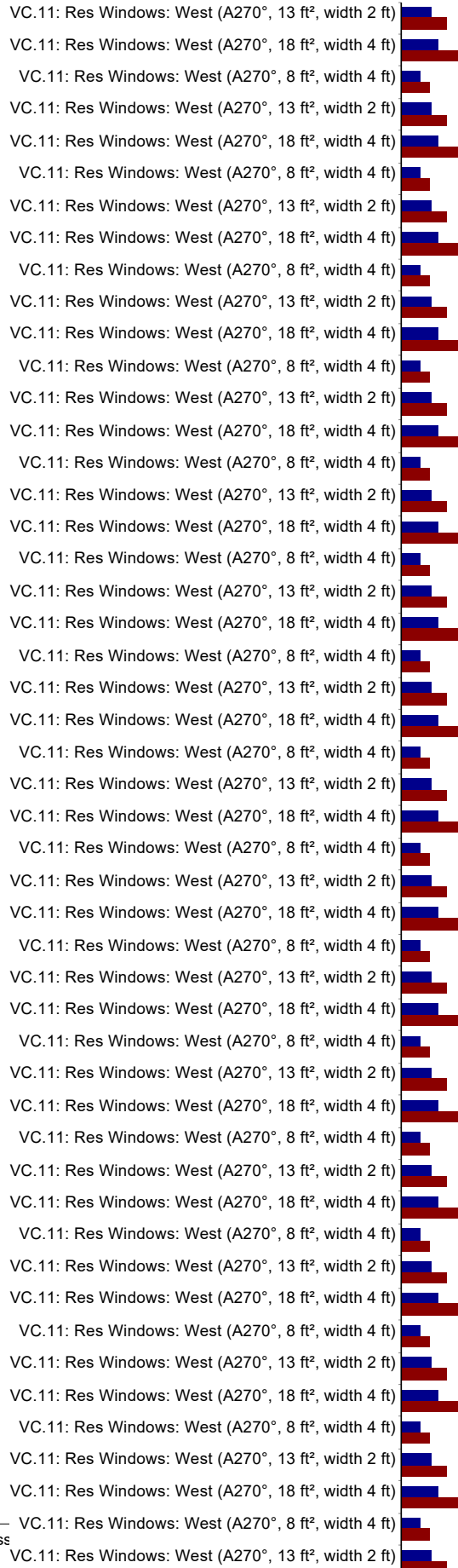
Transmission heat losses - windows (continue)



Transmission heat losses - windows (continue)



- Heating period
- Cooling period

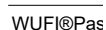




Transmission heat losses - windows (continue)



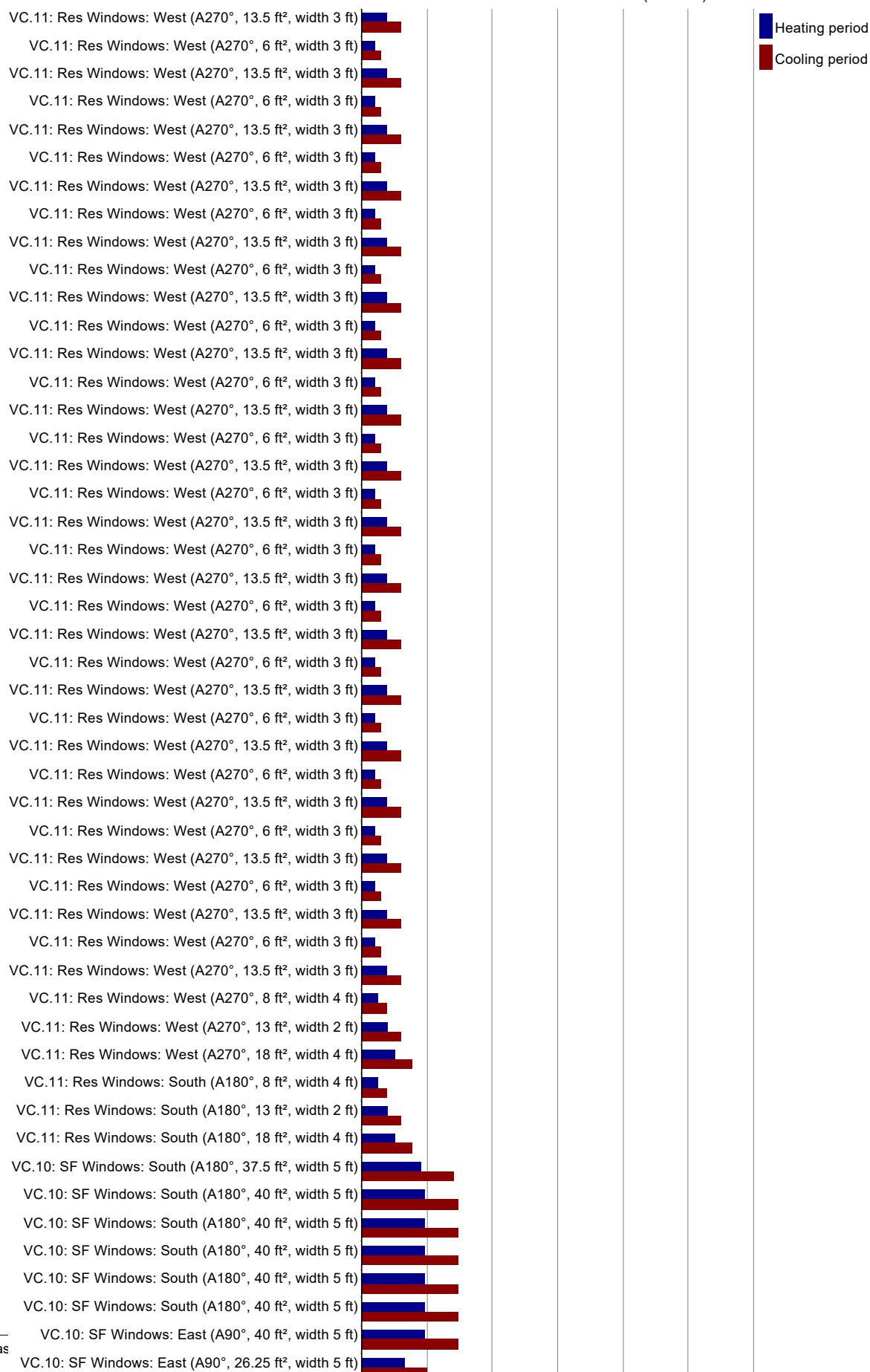
■ Heating period  
■ Cooling period

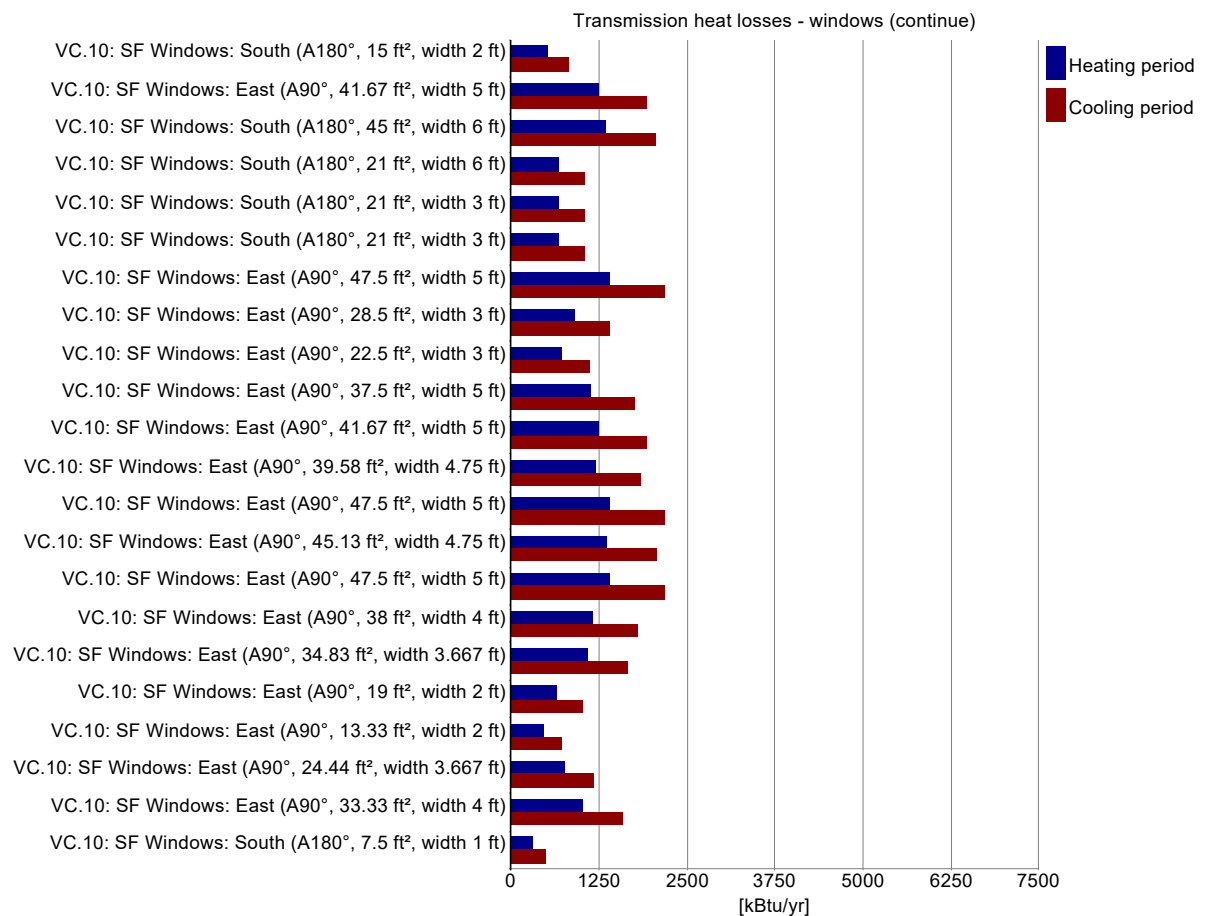


- Heating period
- Cooling period



Transmission heat losses - windows (continue)

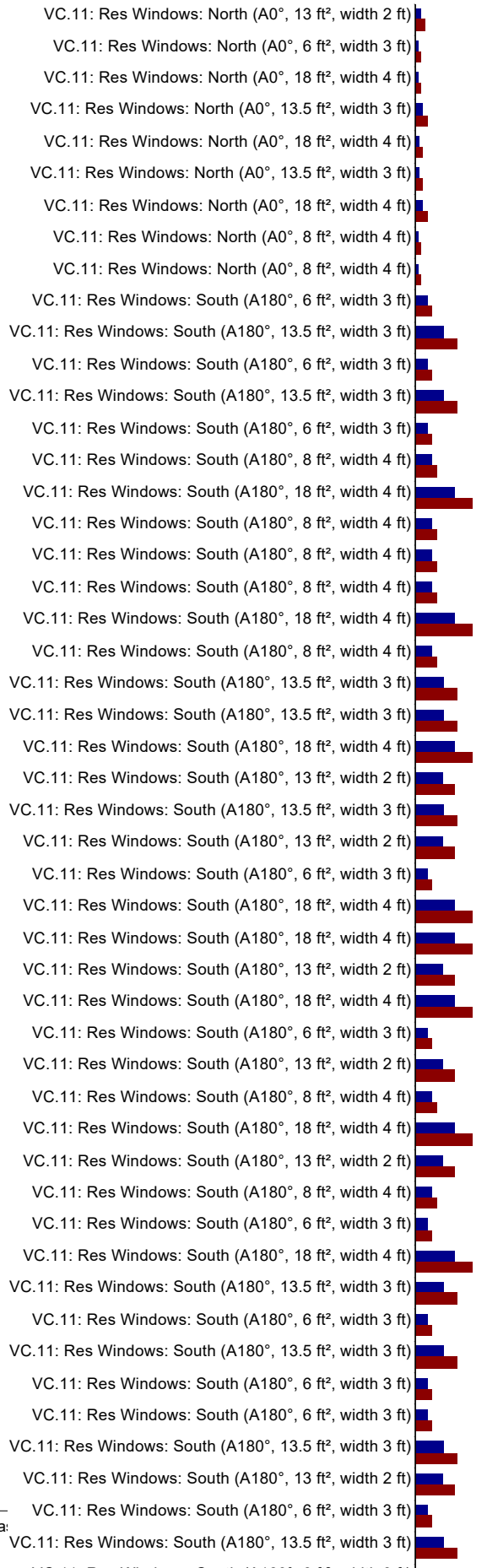




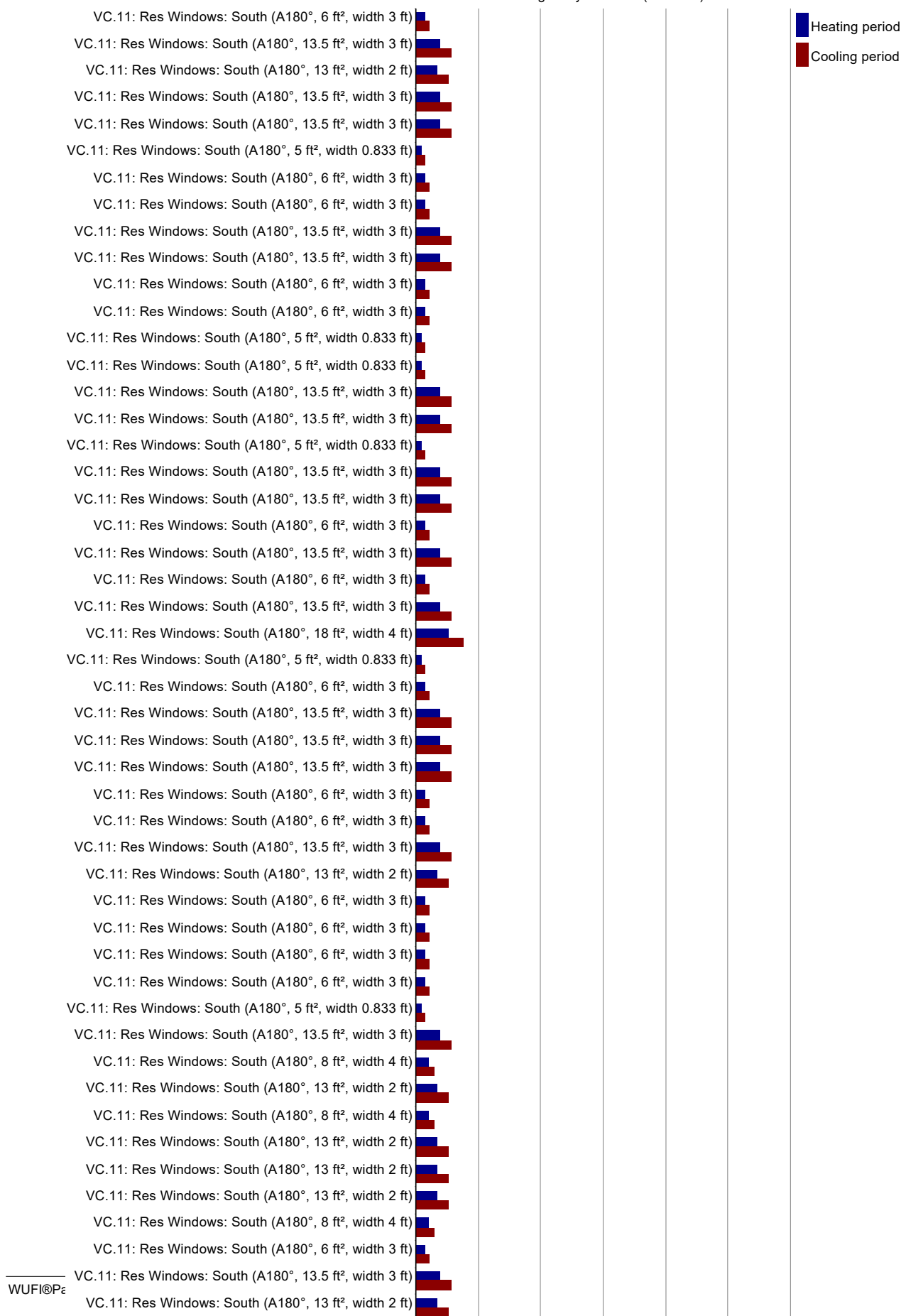
Solar gain by windows







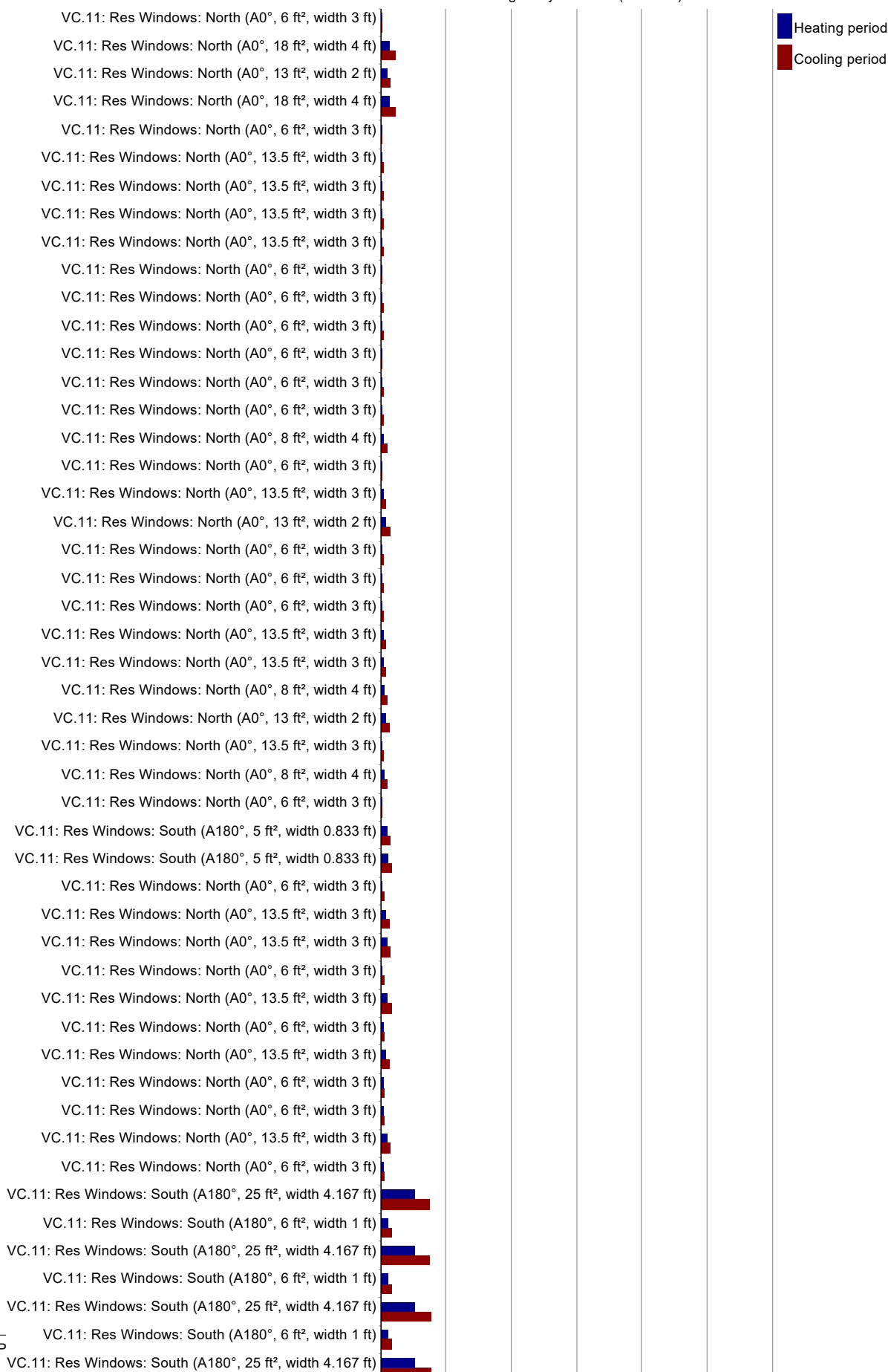
Solar gain by windows (continue)



Solar gain by windows (continue)



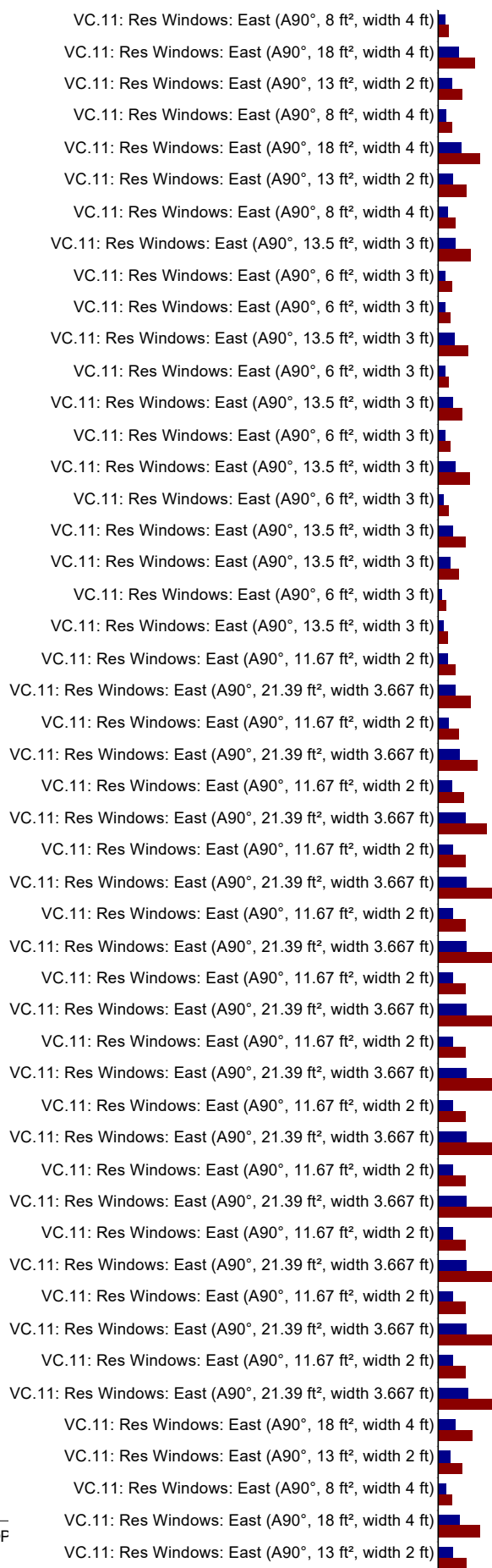
Solar gain by windows (continue)



Solar gain by windows (continue)

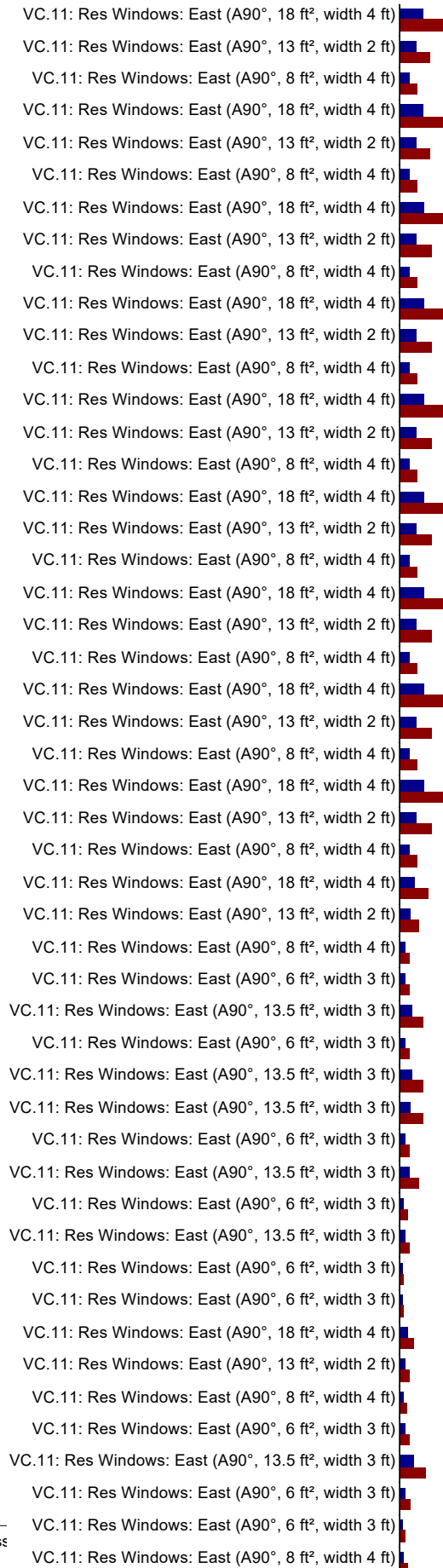


■ Heating period  
■ Cooling period



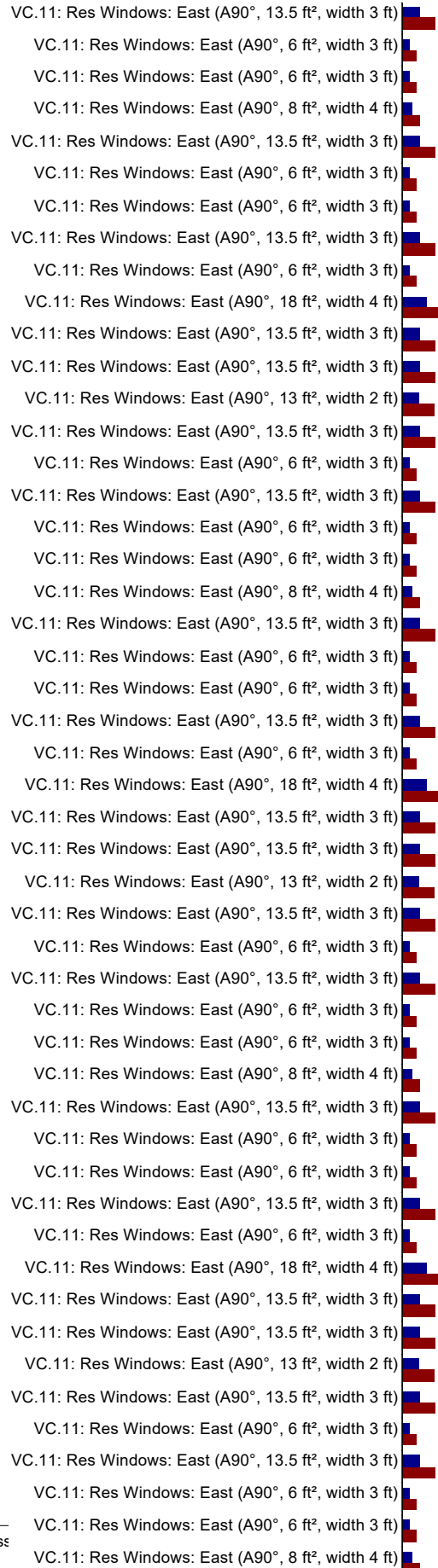


- Heating period
- Cooling period









■ Heating period  
■ Cooling period

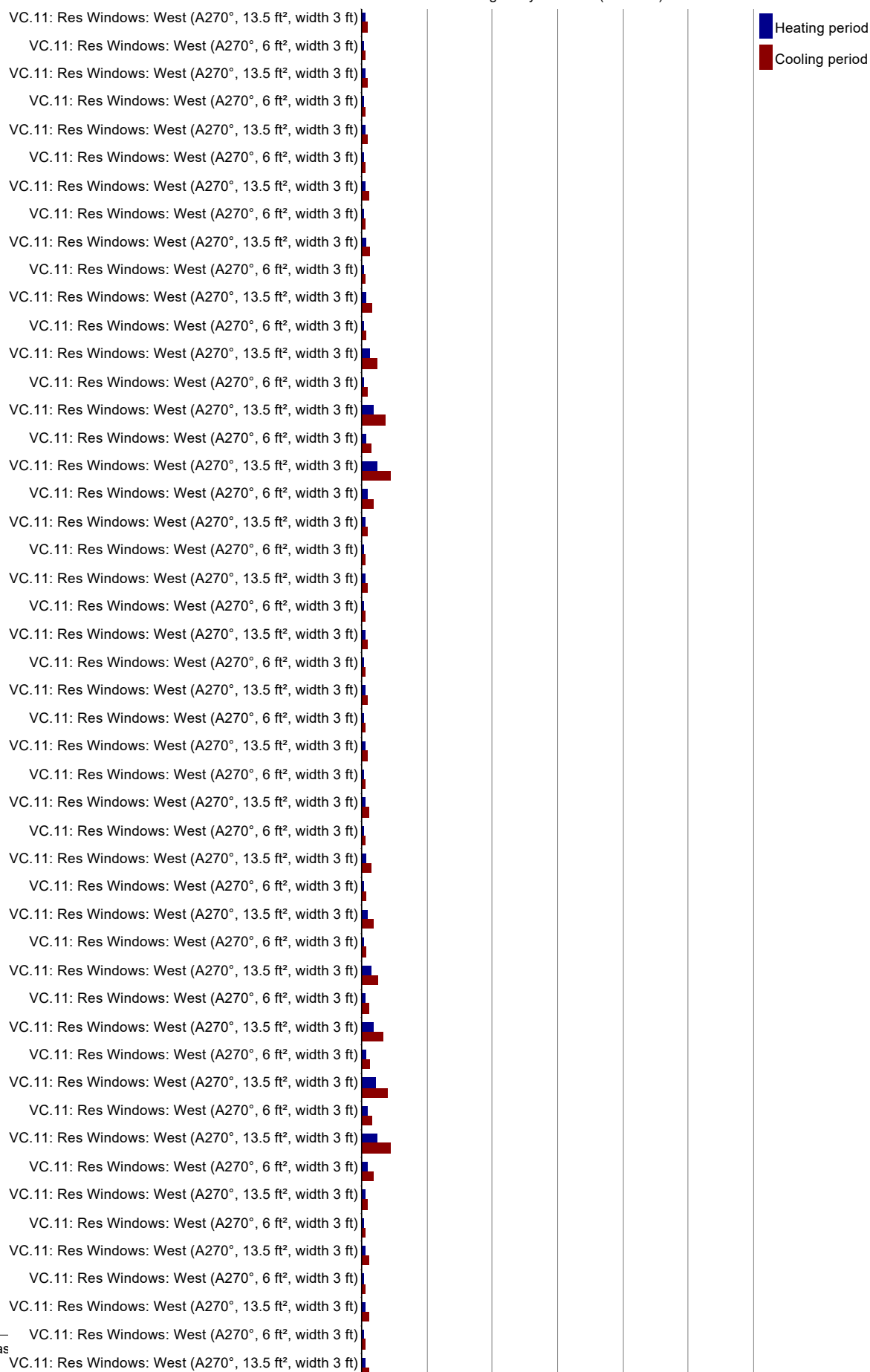


Solar gain by windows (continue)





Solar gain by windows (continue)

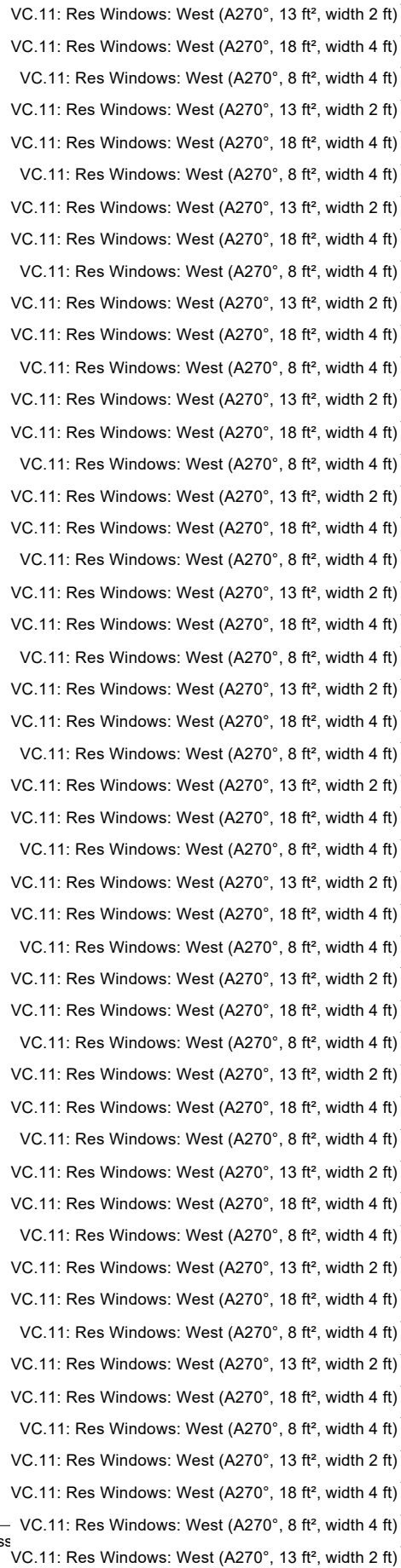


Solar gain by windows (continue)

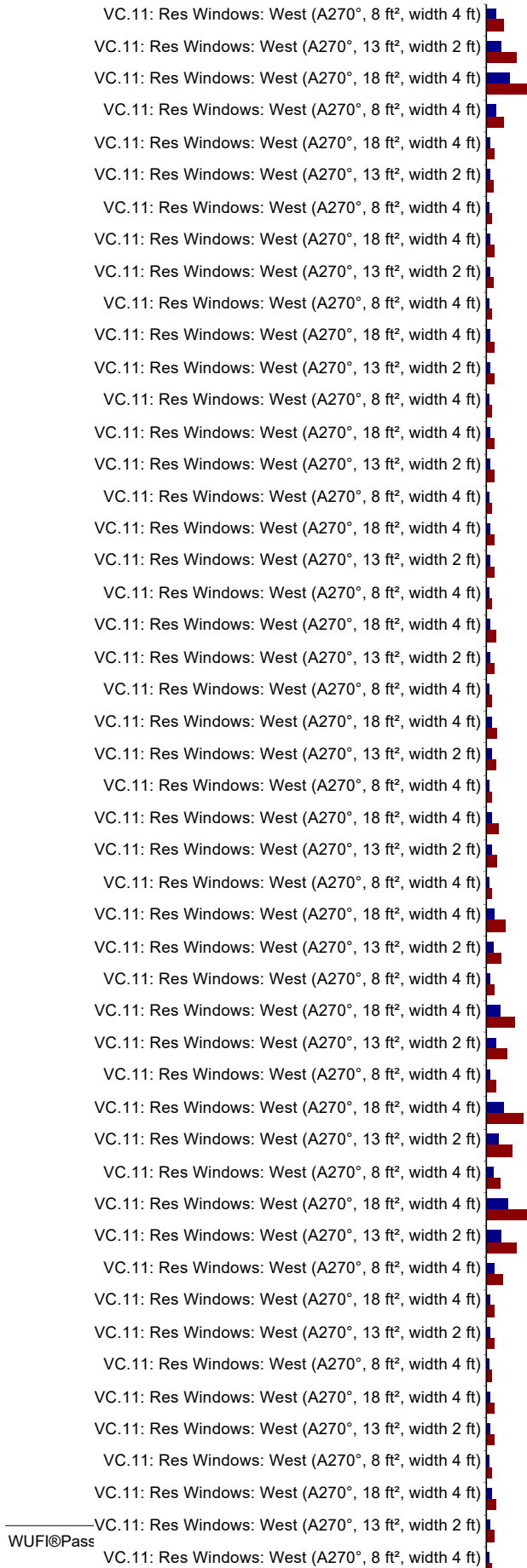


## Solar gain by windows (continue)

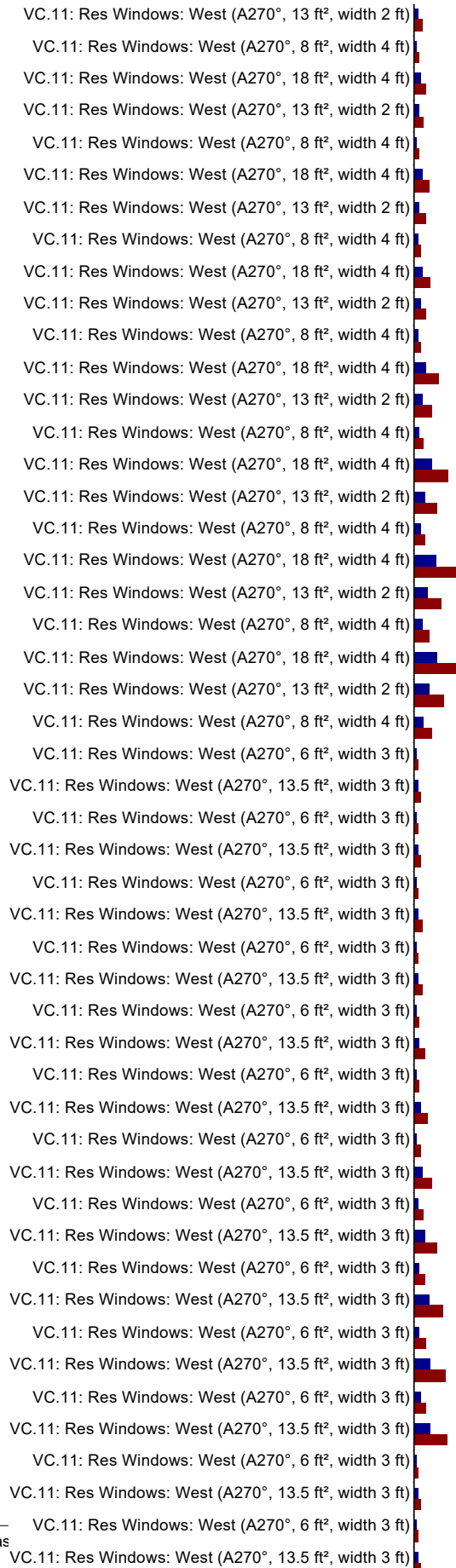


[illegible]

- Heating period
- Cooling period



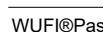
- Heating period
- Cooling period

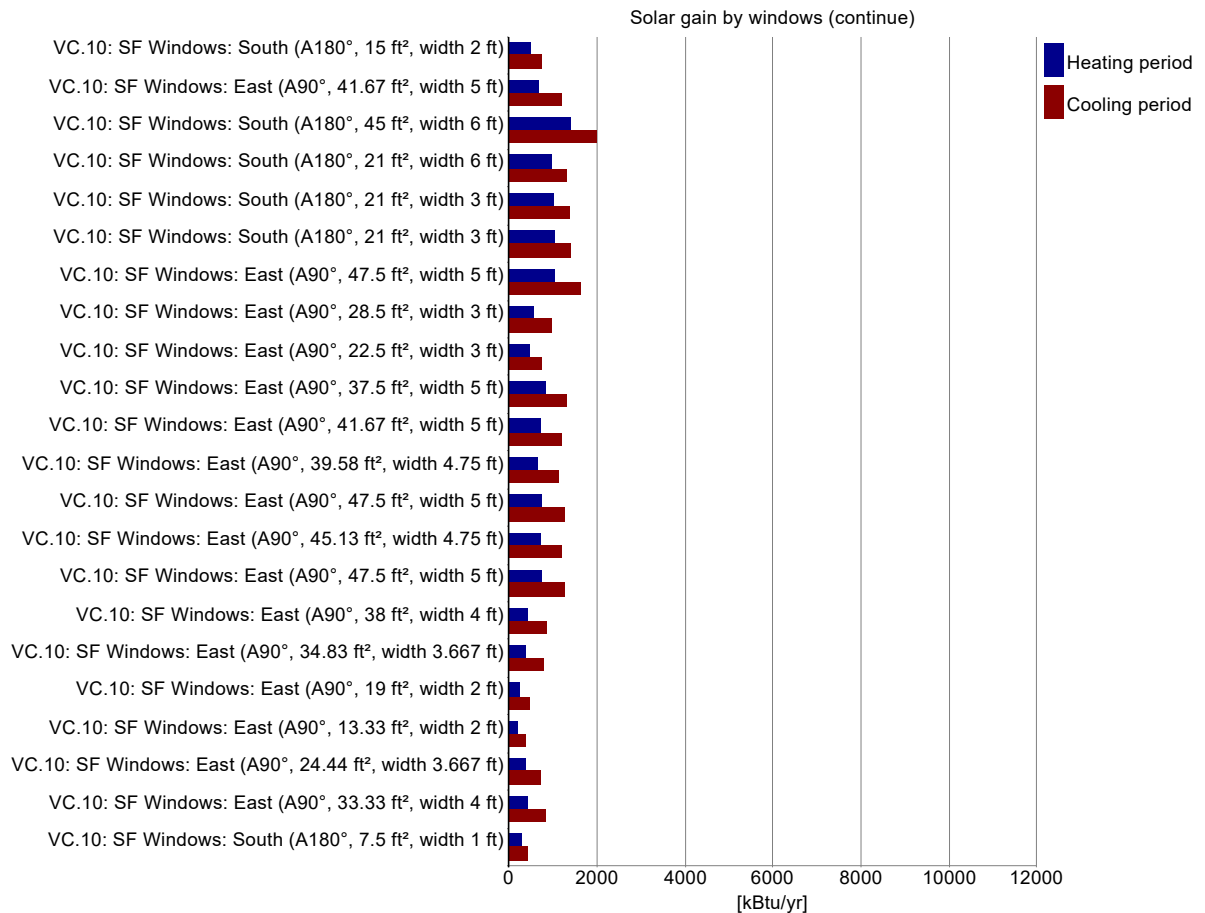




- Heating period
- Cooling period

[illegible]





### Summary building envelope

	Total area / length	Average U-value / Psi value	Transmission losses
Exterior wall ambient:	<b>59,127.6</b> ft²	<b>0.034</b> Btu/hr ft² °F	<b>311,120.1</b> kBtu/yr
Exterior wall ground:	<b>4,984</b> ft²	<b>0.11</b> Btu/hr ft² °F	<b>36,756.6</b> kBtu/yr
Basement:	<b>7,549.6</b> ft²	<b>0.106</b> Btu/hr ft² °F	<b>53,404.1</b> kBtu/yr
Roof:	<b>12,892.6</b> ft²	<b>0.02</b> Btu/hr ft² °F	<b>40,315.9</b> kBtu/yr
Windows:	<b>12,888.9</b> ft²	<b>0.236</b> Btu/hr ft² °F	<b>474,383.4</b> kBtu/yr
Doors:	<b>155.7</b> ft²	<b>0.143</b> Btu/hr ft² °F	<b>3,475.5</b> kBtu/yr
Thermal bridge ambient:	<b>0</b> ft	<b>0</b> Btu/hr ft °F	<b>0</b> kBtu/yr
Thermal bridge perimeter:	<b>0</b> ft	<b>0</b> Btu/hr ft °F	<b>0</b> kBtu/yr
Thermal bridge floor slab:	<b>0</b> ft	<b>0</b> Btu/hr ft °F	<b>0</b> kBtu/yr

### Shading

	Heating	Cooling
Reduction factor North:	<b>37.9</b> %	<b>36.2</b> %
Reduction factor East:	<b>68.8</b> %	<b>70.8</b> %
Reduction factor South:	<b>68.5</b> %	<b>57.7</b> %
Reduction factor West:	<b>37.4</b> %	<b>38.4</b> %
Reduction factor Horizontal:	<b>100</b> %	<b>100</b> %

System	DHW - final energy		Heating - final energy		Total		
	DHW		Heating				
	<div><div></div><div>Heat pump 0 %</div></div>	Final energy demand [Btu/yr]	Covered heating demand [%]	Estimate solar fraction [%]	<div><div></div><div>Heat pump 0 %</div></div>	CO2 equivalent emissions [lb/yr]	Source energy demand [kBtu/yr]
Heat pump, Daikou Emerion REYQ288AA (24 ton)	<div><div></div><div>Heat pump 100 %</div></div>	0	100	0	<div><div></div><div>Heat pump 100 %</div></div>	043,850.8	350,674.9
Heat pump, Daikou Emerion REYQ288AA (24 ton)		2,190.8	0	0		449,272.1	384,381.6
Σ		2,190.8	100	0		1,493,123	735,056.4

## COOLING UNITS

	sensible	latent
Air cooling:	0 kBtu/ft²yr	0 kBtu/ft²yr
Recirculation cooling:	3.5 kBtu/ft²yr	0 kBtu/ft²yr
Additional dehumidification:		0.4 kBtu/ft²yr
Panel cooling:	0 kBtu/ft²yr	
Sum:	3.5 kBtu/ft²yr	0.4 kBtu/ft²yr

## VENTILATION

## Energy transportable by supply air

## Heating energy

transportable: **2.12 W/ft<sup>2</sup>**load: **0.94 W/ft<sup>2</sup>**

## Cooling energy

transportable: **1.22 W/ft<sup>2</sup>**load: **0.71 W/ft<sup>2</sup>**Infiltration pressure test ACH50: **0.33 1/hr**Total extract air demand: **11,830 cfm**Supply air per person: **18 cfm**Occupancy: **312**Average air flow rate: **13,014.78 cfm**Average air change rate: **0.6 1/hr**Effective ACH ambient: **0.2 1/hr**Effective ACH ground: **0 1/hr**Energetically effective air exchange: **0.2 1/hr**Infiltration air change rate: **0.02 1/hr**Infiltration air change rate (heating load): **0.06 1/hr**Type of ventilation system: **Balanced PH ventilation**Wind screening coefficient (e): **0.07**Wind exposure factor: **15**Wind shield factor: **0.05**Ventilation heat losses: **642,812.55 kBtu/yr**

## Devices

Name	Sensible recovery efficiency [-]	Electric efficiency [W/cfm]	Heat recovery efficiency SHX [-]	Effective recovery efficiency [-]
Addison PROH (or equal)	0.8	0.09	0	0.8
Altogether	0.7	0.08	0	0.7

## Ducts

Name	Length (total) [ft]	Clear cross-section [ft <sup>2</sup> ]	U-value [Btu/hr ft <sup>2</sup> °F]	Assigned ventilation units
Supply / outdoor air duct	5	2.2222	7.34	Addison PROH (or equal)
Extract / Exhaust air duct	5	2.2222	7.34	Addison PROH (or equal)
Σ	10			

\*length \* quantity

\*\* thermal conductivity / thickness

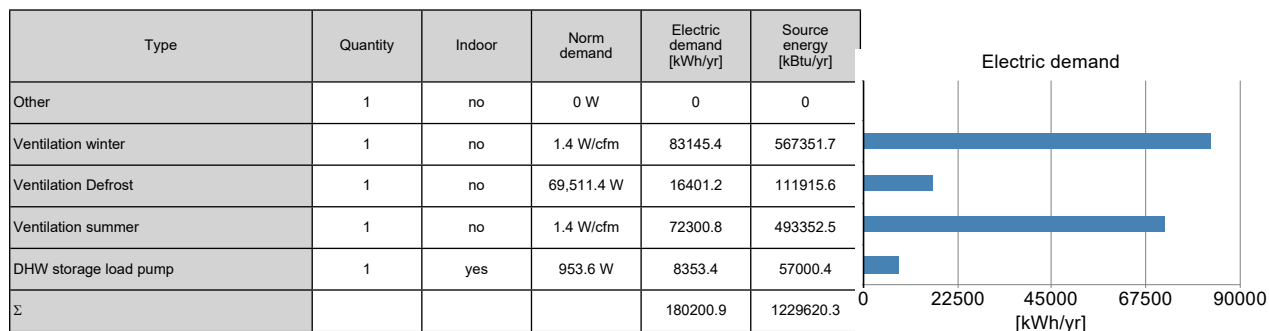
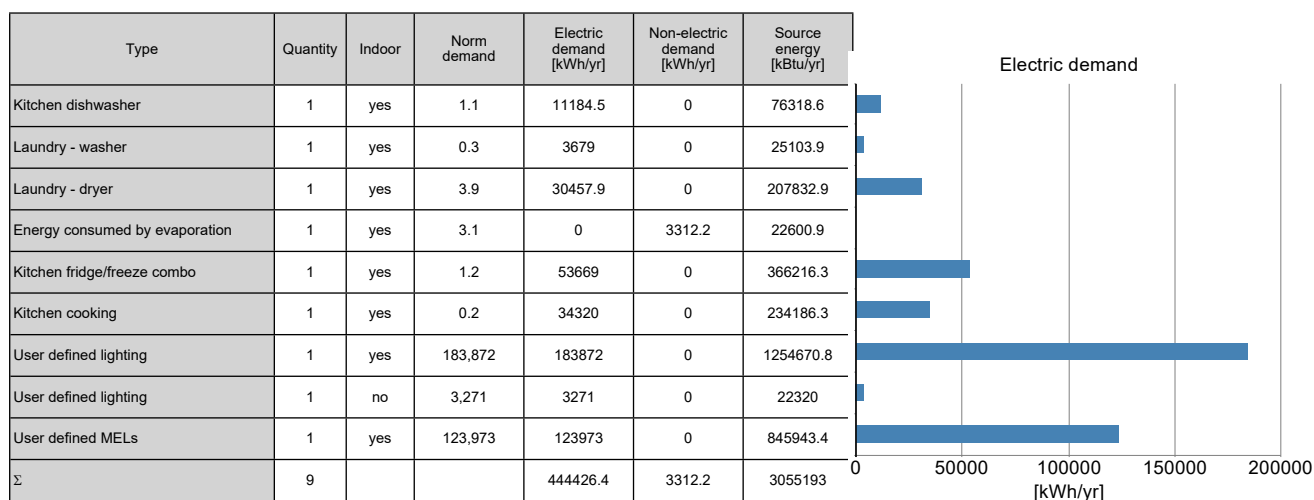
## SUMMER VENTILATION

ACH night ventilation: **0 1/hr**ACH natural summer: **0 1/hr**Mechanical ventilation summer: **0.6 1/hr**

WUFI® Passive V.3.5.0.1: Venuti Elizabeth/enviENERGY Studio West End Library Development / West End Library Development

Mechanical ventilation summer with HR:

yes

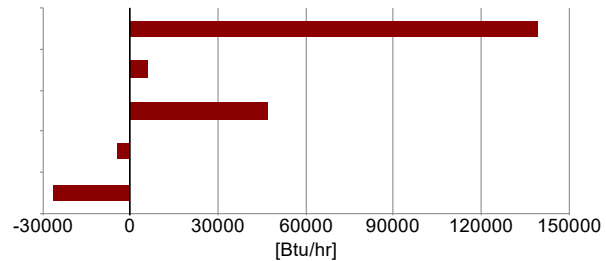
**ELECTRICITY DEMAND - AUXILIARY ELECTRICITY****ELECTRICITY DEMAND RESIDENTIAL BUILDING**



## INTERNAL HEAT GAINS

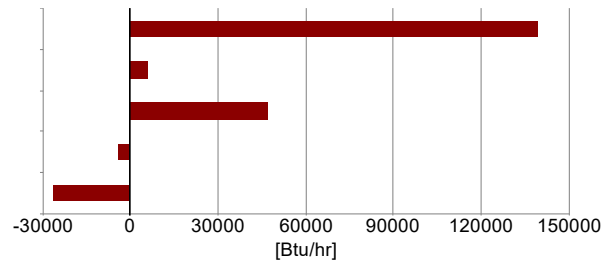
## Heating season

Electricity total:	<b>139,313</b> Btu/hr
Auxiliary electricity:	<b>6,083.2</b> Btu/hr
People:	<b>46,841.9</b> Btu/hr
Cold water:	<b>-4,353.9</b> Btu/hr
Evaporation:	<b>-26,614.7</b> Btu/hr
$\Sigma$ :	<b>161,269.4</b> Btu/hr
Specific internal heat gains:	<b>1.2</b> Btu/hr ft <sup>2</sup>



## Cooling season

Electricity total:	<b>139,313</b> Btu/hr
Auxiliary electricity:	<b>6,083.2</b> Btu/hr
People:	<b>46,841.9</b> Btu/hr
Cold and hot water:	<b>-3,834.7</b> Btu/hr
Evaporation:	<b>-26,614.7</b> Btu/hr
$\Sigma$ :	<b>161,269.4</b> Btu/hr
Specific internal heat gains:	<b>1.2</b> Btu/hr ft <sup>2</sup>



**DHW AND DISTRIBUTION**

DHW consumption per person per day: **6.6** gal/Person/day

Average cold water temperature supply: **52.8** °F

Useful heat DHW: **562,571.1** kBtu/yr

Specific useful heat DHW: **4,067** Btu/ft²yr

Total heat losses of the DHW system: **2,695.9** kBtu/yr

Specific losses of the DHW system: **19.5** Btu/ft²yr

Performance ratio DHW distribution system and storage: **1**

Utilization ratio DHW distribution system and storage: **1**

Total heat demand of DHW system: **565,267** kBtu/yr

Total specific heat demand of DHW system: **4,086.5** Btu/ft²yr

Total heat losses of the hydronic heating distribution: **0** kBtu/yr

Specific losses of the hydronic heating distribution: **0** Btu/ft²yr

Performance ratio of heat distribution: **100** %

Region	Length [ft]	Annual heat loss [kBtu/yr]
Hydronic heating distribution pipes		
Σ	0	0
DHW circulation pipes		
In conditioned space	0	0
Σ	0	0
Individual pipes		
In conditioned space		0
Σ		0
Water storage		
Device 2 (Water storage: DHW): Lync Storage Tank		2426.5
Σ		2426.5

## **Appendix E – Affirmative Fair Housing Checklist**

## Article 80 - Affirmative Furthering Fair Housing Assessment Tool

Proponents of Large Projects, Planned Development Areas (PDAs), and Planned Development Area Master Plans that feature a housing component must submit this form with each Project Notification Form and/or Notice of Project Change. If this is a multi-building and/or multiphase project you must submit a separate assessment for each building and/or phase. For PDAs you must submit an assessment for the entire PDA as well as for each Proposed Project within the PDA.

For more information on how to complete this form see [The AFFH Assessment and Submission Guide](#). To complete this form electronically as a Google Form visit: <https://bit.ly/38qXmh0>. If completing this form as a Word Doc (i.e. not electronically using the Google Form) please submit this form with the rest of your Article 80 filings. For questions about this form please email Michelle McCarthy, Housing Policy Manager at [michelle.mccarthy@boston.gov](mailto:michelle.mccarthy@boston.gov).

***Please remember to include all necessary and/or required attachments.***

Section 1: Submission Information-Primary Contact			
Date:	January 3 <sup>rd</sup> , 2025		
Name:	Kristel Salinas	Title:	Project Manager
Company:	Preservation of Affordable Housing, Inc.		
Email:	ksalinas@poah.org	Phone:	(617) 449-0876
What type of project is this submission for?	<input checked="" type="checkbox"/> Large Project: Single building/phase <input type="checkbox"/> Large Project: Multi-building/phase <input type="checkbox"/> Planned Development Area <input type="checkbox"/> Project located within a Planned Development Area <input type="checkbox"/> Other (please explain):		
At what stage in the Development Review process is this submission being made?	<input checked="" type="checkbox"/> Project Notification Form <input type="checkbox"/> Notice of Project Change <input type="checkbox"/> Response to a Supplemental Information Request <input type="checkbox"/> Other (please explain):		

Section 2: Development Team Information-Primary Contact			
Proponent/Owner			
Name:	Kristel Salinas	Title:	Project Manager
Company:	Preservation of Affordable Housing, Inc.		
Email:	ksalinas@poah.org	Phone:	617.449.0876
Attorney			
Name:	Michael Flannery	Title:	Director
Company:	Goulston & Storrs		
Email:	MFlannery@GOULSTONSTORRS.com	Phone:	617.574.3807
Marketing Agent			
Name:	TBD	Title:	
Company:	POAH Communities		
Email:		Phone:	

BPDA Staff			
Project Manager:	Camille Platt	Planner:	

## Article 80 - Affirmative Furthering Fair Housing Assessment Tool

Section 3: Proposed Project Overview	
A. Proposed Project Information	
Project Name	West End Library
Project Address(es)	151 Cambridge Street, Boston MA 02114
What is the square footage of the Proposed Project Site?	22,195 SF Proposed Lot Area
Purchase Date of Proposed Project Site	TBD - We anticipate executing a Ground Lease with the City of Boston at a later date.
Is the Proposed Project located in a Planning Area or subject to a Planning Initiative? If, yes please describe.	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (please describe):
Is the Proposed Project located within a Landmark District or an Architectural Conservation District? If yes, please describe.	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (please describe):
Are there any current or expiring affordability restrictions, special property tax agreements, or similar (e.g. Urban Renewal, Section 8, 121A, etc.) on any existing building within the Proposed Project Site	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (please describe):
B. Proposed Project Description	
What is the construction classification of the Proposed Project?	<input checked="" type="checkbox"/> New Construction <input type="checkbox"/> Rehabilitation <input type="checkbox"/> Other (please describe):
Total anticipated number Phases and/or Buildings	1
What is the anticipated residential square footage at the Proposed Project?	157,452 SF including all supporting program BOH spaces
How many residential units are anticipated at the Proposed Project?	119 units
Are residential units anticipated to be rentals or homeownership units? If there will be a mix, please describe.	<input checked="" type="checkbox"/> Rentals: <b>119</b> <input type="checkbox"/> Homeownership Units: <input type="checkbox"/> Mix (please describe):
Indicate how many units of each bedroom size are anticipated at the Proposed Project.	Studio: 12 1 Bed: 29 2 Bed: 70 3 Bed: 8 4+ Bed:
Indicate how many units accessible to persons with disabilities (i.e. fully built-out Group 2 units) are anticipated at the Proposed Project.	12 units will be mobility accessible Group 2 units (10%) and 3 units will be sensory units (2%)
How many total units will be financially available to tenants with Housing Choice Vouchers (i.e. Section 8	We anticipate 40 units will be supported by project-based vouchers (a mix of Section 8 and MRVP vouchers). Further,

## Article 80 - Affirmative Furthering Fair Housing Assessment Tool

vouchers) and/or other state or local housing vouchers? Payment standards for Boston Housing Authority Vouchers are <a href="#">here</a> .	based on today's AMI levels and today's published Fair Market Rents (FMR's), all units will be financially available to tenants with Housing Choice Vouchers assuming all units are FMR.
Are any units anticipated to be <a href="#">Compact Living</a> units? If yes, list the total number of compact units.	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes-Total Number of Compact Units:
Indicate how many compact units of each bedroom size are anticipated at the Proposed Project.	Studio 1 Bed: 2 Bed: 3 Bed: 4+ Bed:
Are there non-residential uses anticipated at the Proposed Project Site? If yes, please describe.	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (please describe): <b>The first two stories of the building will serve as a public library.</b>
Is the Proposed Project anticipated to be subject to Development Impact Project Exactions (i.e.: Linkage)? If yes, please indicate the anticipated amount of each exaction.	<div style="display: flex; align-items: flex-start;"> <div style="margin-right: 20px;"> <input checked="" type="checkbox"/> No  <input type="checkbox"/> Yes:         </div> <div>           Anticipated Housing Exaction:   \$ N/A            Anticipated Jobs Exaction:       \$ N/A         </div> </div>

### Section 4: Displacement Risk at the Proposed Project Site

#### A. Previous and Current Uses of the Proposed Project Site

Have there been any buildings on the Proposed Project Site at any time in past two years or, if applicable, since zoning relief was granted at the Proposed Project Site, whichever is longer?	<input type="checkbox"/> No ( <b><u>Skip to Section 5: Inclusionary Development Policy</u></b> )  <input checked="" type="checkbox"/> Yes
Are there any buildings on the Proposed Project Site currently? Choose the one option that best applies.	<input checked="" type="checkbox"/> Yes, and some or all are currently occupied. <input type="checkbox"/> Yes, they are all currently vacant and have been vacant for the past two years. ( <b><u>Skip to Section 5: Inclusionary Development Policy.</u></b> ) <input type="checkbox"/> Yes, they are all currently vacant but have not been vacant for all the past two years. <input type="checkbox"/> No, but there were buildings at the site in the past two years. <input type="checkbox"/> No, there have been no buildings at the site in the past two years. ( <b><u>Skip to Section 5: Inclusionary Development Policy</u></b> )
To the best of your knowledge, describe all uses, including temporary uses at the Proposed Project Site within the past two years. If you are unable to answer this question, please explain why.	The current site of the West End Library serves as a public library offering study spaces, and community programs such as workshops for all ages. Temporary uses have included public and community engagement events.



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What types of tenants and/or occupants are currently present at the Proposed Project Site?	<input type="checkbox"/> Residential Only <input type="checkbox"/> Commercial Only ( <b><u>Skip to Section 4.C Past and Current Residential Use Details</u></b> ) <input type="checkbox"/> Both residential and commercial <input checked="" type="checkbox"/> Other (please describe): The current site of the West End Library serves as a public library. <input type="checkbox"/> None ( <b><u>Skip to Section 5: Inclusionary Development Policy</u></b> )
<b>B. Past and Current Residential Use Details</b>	
How many residential buildings at the Proposed Project Site are currently occupied?	0
How many residential units currently exist at the Proposed Project Site? List the number of vacant units and the number of occupied units.	Vacant Units: 0 Occupied Units: 0
For each unit vacated within the past two years list the vacancy date for each unit, to the best of your knowledge. <b><u>Please indicate if you are attaching a separate list.</u></b>	There are no vacant units.
Of the units vacated within the past two years, were any occupied by subsidized housing voucher holders (i.e. Section 8, MRVP, CoC PSH, etc.)?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (please describe):
Of the currently occupied units, are any occupied by subsidized voucher holders (i.e. Section 8, MRVP, CoC PSH, etc.)?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (please describe):
Of the units vacated within the past two years, were any occupied by persons with disabilities?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (please describe):

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Of the currently occupied units, are any occupied by persons with disabilities?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (please describe):
Which of the following tenancy actions have taken place at the Proposed Project Site within the past two years? Indicate the number of times each action has taken place within that time period, to the best of your knowledge.	<input type="checkbox"/> Tenant voluntarily vacated unit at expiration of lease or tenancy at will period: <input type="checkbox"/> Tenant vacated unit due to a rent increase: <input type="checkbox"/> Notice to Quit issued for cause (i.e. non-payment of rent; lease violation): <input type="checkbox"/> Notice to Quit issued for no cause: <input type="checkbox"/> Tenant formally evicted for cause: <input type="checkbox"/> Tenant formally evicted for no cause: <input type="checkbox"/> Tenant vacated unit because of change in ownership and/or intent to develop: <input checked="" type="checkbox"/> Other (please describe): There are no tenants in the building other than the public library staff.
Have residential tenants been informed of any ownership changes?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (please provide date, and attach a representative example of the notice)
If condominiums are anticipated within the Proposed Project, have current tenants been informed of their rights under the <a href="#">Condominium Conversion Act</a> ?	<input checked="" type="checkbox"/> No, the Proposed Project is 100% rental units. <input type="checkbox"/> No, tenants have not yet been informed. <input type="checkbox"/> Yes (please provide date and attach a copy of the notification):
Provide the date on which the Department of Neighborhood Development Office Housing Stability was informed of intent to develop the Proposed Project Site, as applicable. <b>Please attach a copy of the notification.</b>	The Mayor's Office of Housing put out an RFP on April 3 <sup>rd</sup> , 2023 for the development of the West End Library. The developers, Preservation of Affordable Housing and Caste Capital, were selected to develop the project December 2023 and received the Mayor's Executive Order on October 10 <sup>th</sup> 2024.
Please provide information on what types of permanent relocation and/or financial assistance has been provided to tenants. If none, what assistance do you plan to provide to tenants to assure housing stability?	N/A. No tenants have been and will be displaced from the property as it is a public library.
If you have been unable to answer any of the questions in Section 4.B-especially those questions relating to use and/or occupancy of the Proposed Project Site within the past two years-please explain why.	N/A

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<b>C. Past and Current Commercial Use Details</b>	
How much commercial square footage is currently present at the Proposed Project Site?	Vacant: 0 Occupied: 0. The current site is a public library and not served for commercial purposes.
<p>In a separate attachment for each commercial space currently occupied or occupied within the past two years, please provide the following information, as available: N/A</p> <ul style="list-style-type: none"> <li>Current status (i.e. vacant or occupied)</li> <li>Square Footage</li> <li>Name of business or organization</li> <li>Type of business or organization</li> <li>If the tenant is or was a minority or woman owned business</li> <li>Length of time the business or organization has or had been at the Proposed Project Site</li> <li>The preferred language of tenant</li> </ul>	
Are there any specific commercial tenants expected after development?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (please describe):
Are there any specific minority or woman owned business tenants anticipated after development?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (please describe):

Section 5: Inclusionary Development Policy (IDP)					
Is the <a href="#">IDP</a> anticipated to apply to the Proposed Project?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No (please explain why and then skip to <b>Section 6: Strategy for Addressing AFFH Goals</b> ): IDP is not applicable to the West End Library project because the project will be 100% affordable.				
In which <a href="#">IDP Zone</a> is the Proposed Project Located?	<input type="checkbox"/> Zone A <input type="checkbox"/> Zone B <input type="checkbox"/> Zone C				
How is the Proposed Project anticipated to meet IDP obligations? Check all that apply.	<input type="checkbox"/>	On-site units	Number anticipated:		Percent of total
	<input type="checkbox"/>	Off-site units	Number anticipated:		Percent of total
	<input type="checkbox"/>	Payment into IDP fund	Amount anticipated	\$	
How many IDP units are anticipated as rental units and how many units are anticipated as homeownership units?	On-site rental: Off-site rental: On-site homeownership: Off-site homeownership:				
What is the total anticipated square footage for all on-site IDP units?	Rental Square Footage:		Percent of total square footage:		
	Homeownership Square Footage:		Percent of total square footage:		

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Indicate the anticipated number IDP units by bedroom size at the Proposed Project site, including the number of Compact Living IDP units for each bedroom size.	Total IDP Studio:		Compact IDP Studio:	
	Total IDP 1 Bed:		Compact IDP 1 Bed:	
	Total IDP 2 Bed:		Compact IDP 2 Bed:	
	Total IDP 3 Bed:		Compact IDP 3 Bed:	
	Total IDP 4+ Bed:		Compact IDP 4+ Bed:	
Indicate the number of anticipated IDP units that will be made accessible to persons with disabilities (fully built-out MAAB Group 2 units).				
Indicate the number of anticipated IDP units by AMI at the Proposed Project Site	<b>Rental Units</b>		<b>Homeownership Units</b>	
	30% AMI:		60% AMI:	
	40% AMI:		70% AMI:	
	50% AMI:		80% AMI:	
	60% AMI:		90% AMI:	
	70% AMI:		100% AMI:	
	Other (please describe):		Other (please describe):	
If off-site units are anticipated, please describe host site, partnerships, anticipated funding, and development timeline.				
If you are unable to provide the specific details for any question in Section 5, please explain when these details are expected to be available for review.				

### Section 6: Strategy for Addressing AFFH Goals

Proponents must consult the [Housing and Household Composition Community Profile Report](#) and the [Department of Neighborhood Development Displacement Risk Index and Maps](#) in order to complete this section. For more information on how to complete this section see [The AFFH Assessment and Submission Guide](#). The Boston Interagency Fair Housing Development Committee (BIFDC) may request Proponents to consider different or additional Intervention Options after submission of this form and prior to its recommendation to the BPDA Board.

#### A. Intervention Options & Intervention Enhancements

Indicate which Article 80 Intervention Options will be incorporated into the Proposed Project. All projects must select at least one option. Selection(s) must be proportional to the size, scope, and impact of the Proposed Project. Certain	<input type="checkbox"/>	Provide an additional percentage of IDP units than required:
	<input type="checkbox"/>	Deepen the affordability of IDP units
	<input type="checkbox"/>	Provide all IDP units on-site
	<input type="checkbox"/>	Provide higher proportion of 2+ bedroom IDP units than required
	<input type="checkbox"/>	Meet or exceed proportion of market rate 2+ bedroom units in the community
	<input type="checkbox"/>	Increase the number fully built-out Group 2 units accessible to persons with disabilities

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<p>projects may be required to select more than one option as an Intervention Enhancement.</p>	<input type="checkbox"/>	<p>Increase building density to directly increase affordable units for and available to people in protected classes</p>
	<input checked="" type="checkbox"/>	<p>Agree to apply to host Project Based Vouchers or Rental Assistance Demonstration units onsite, in addition to meeting IDP</p>
	<input type="checkbox"/>	<p>Partner with a non-profit developer, land trust, housing authority, or other entity to provide land or bear some capital costs to enable affordable housing construction, in addition to fulfilling IDP requirements</p>
	<input checked="" type="checkbox"/>	<p>Other (please describe): <b>POAH Communities Property Management Services</b></p>
<p>For each Article 80 Intervention Option selected, describe how many units the proposed Intervention options will apply to. Please distinguish between market-rate and IDP units. Refer to the AFFH Submission Guidance document for more information on what information should be included for each Article 80 Intervention Option.</p>	<p><b>Apply to host Project Based Vouchers:</b> The project will be 100% affordable, with all 119 units income-restricted within the range of 30% to 80% of the Area Median Income (AMI). Of these, 40 units will be restricted to households earning up to 30% AMI. 32 units will be designated as project-based voucher (PBV) units through the Faircloth-to-RAD conversion process in collaboration with the Boston Housing Authority (BHA), and 8 units will be designated as Massachusetts Rental Voucher Program (MRVP) units. The HHCCP states that 1.7% of the project area uses housing vouchers compared to the 4.7% of the greater Boston area. Including these PBV and MRVP units in the development will provide housing opportunities for extremely low income (ELI) families in an area with strong economic potential, with convenient access to transit, healthcare, grocery stores, and essential services.</p> <p><b>POAH Communities Property Management Services:</b> As the long-term owner of the project, we will leverage our property management and community impact teams to deliver exceptional management, resident services, and community support. These programs will include career development, financial coaching, and other initiatives aimed at building strong partnerships within the West End community, helping residents build wealth and achieve financial independence. We are deeply committed to the success of this project and view it as a long-term investment in both the community and the future. This includes supporting residents to remain safely, stably and affordably housed; encouraging resident leadership where they live; supporting access to quality healthcare; pledging to grow pathways to quality, affordable childcare and afterschool programs, and adult programs; strengthening partnerships with employers and educational institutions to support income growth for individuals and families.</p>	
<p>Indicate which Marketing &amp; Housing Access Intervention Options will be incorporated into the Proposed Project. All projects must select at least one option. Selection(s) must be proportional to the size, scope, and impact of the Proposed Project.</p>	<input type="checkbox"/>	<p>Provide a preference for an agreed upon percentage of units to rental voucher-holders and develop marketing and tenant selection policies and procedures that are least likely to exclude voucher-holders.</p>
	<input type="checkbox"/>	<p>Provide preference for an agreed percentage of units to families that are currently rent-burdened, have experienced a no-fault eviction, or have experienced eviction but now display the ability to pay and develop marketing and tenant selection policies and procedures that least likely to exclude preferred tenants.</p>
	<input type="checkbox"/>	<p>In the case of homeownership units, provide a preference to first-time/generation Homebuyers and develop marketing policies and procedures that are least likely to exclude preferred homebuyers.</p>
	<input type="checkbox"/>	<p>Allow last month's rent and security deposit to be paid in installments for an agreed upon percentage of units or by renters up to a certain income level</p>

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	<input type="checkbox"/>	Agree to follow best practices related to the use of CORI, eviction, and credit records in the tenant screening and selection process
	<input checked="" type="checkbox"/>	Agree to follow progressive practices related to the use of CORI, eviction, and credit records in the tenant screening and selection process, and in marketing of units, for example following Fair Chance Housing guidelines, and/or waiving eviction and credit checks for affordable units and/or housing voucher-holders.
	<input type="checkbox"/>	Agree to best practices in marketing the market-rate units that are inclusive of and welcoming to members of protected classes
	<input type="checkbox"/>	Other (please describe);
<p>For each Marketing &amp; Housing Access Intervention Option selected, describe how many units the proposed Intervention options will apply to. Please distinguish between market-rate and IDP units. Refer to the AFFH Submission Guidance document for more information on what information should be included for each Marketing &amp; Housing Access Intervention Option.</p>	<p>The proposed intervention, “Agreeing to follow progressive practices related to the use of CORI, eviction and credit records in the tenant screening and selection process, and in marketing of units...” will apply to all 119 units in the development.</p> <p>In the Marketing and Tenant Selection Plan, POAH Communities uses best practices as it related to the use of CORI, eviction and credit records in tenant screening and selection. We plan to use progressive practices by limiting the selection process to only what is necessary in determining and if the tenant is able to pay rent for the term of the lease. This includes but is not limited to:</p> <p>Income and asset verification, landlord verification, CORI, and screening through BetterNOI. Negative backgrounds are reviewed by the Regional Property Supervisor and applicants have the right to appeal. Mitigating circumstances are considered.</p>	
<p>Supplemental Process Options: These are <b>optional</b> Intervention Options a Proponent may propose as an Intervention Enhancement. Supplemental Process options must be legal feasible and must clearly be linked to AFFH goals. Supplemental Process Options will be reviewed by the BIFDC as well as any relevant City departments and/or Agencies before they can be recommended and/or implemented. Examples of Supplemental Process Options are:</p> <ul style="list-style-type: none"> <li>● Establishing a housing stabilization fund</li> <li>● Entering into voluntary deed restriction granting tenants the right of first refusal to purchase property upon conversion or sale</li> <li>● Establishing and/or contributing to a neighborhood housing Acquisition Opportunity Program</li> <li>● Restricting the percentage of non-owner-occupied units</li> <li>● Providing flexible lease options to local, small business tenants in mixed-use developments</li> <li>● Agreeing to support cooperative housing units</li> </ul> <p>Proponents choosing to pursue one or more Supplemental Process Options should attach a description of the proposed Supplement Process Option(s) that describes the scope of the proposed option(s) and how the option is anticipated to be implemented. The BPDA Project Manager and/or BIFDC will follow up with the Proponent requesting any different or additional information necessary to review the proposed Supplemental Option(s).</p>		
<p>If required, indicate which Intervention Enhancements will be incorporated into the Proposed Project. Note: The Boston Interagency Fair Housing</p>	<b>Areas of High Displacement Risk must select one of the following:</b>	
	<input type="checkbox"/>	Diversity Preservation Preferences (if <a href="#">permitted</a> at Proposed Project Site)
	<input type="checkbox"/>	Additional Article 80 Option(s)
	<input type="checkbox"/>	One or more Supplement Process Options
	<b>Areas of High Historical Exclusion must select one of the following:</b>	



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Development Committee may determine that the Proposed Project is in an Area of High Displacement Risk and/or Area of High Historical Exclusion after submission of this form.	<input type="checkbox"/>	Build all IDP units on-site
	<input type="checkbox"/>	Additional Article 80 Option(s)
	<input type="checkbox"/>	One or more Supplement Process Options
	<b><i>Planned Development Areas (PDA) must select one of the following</i></b>	
	<input type="checkbox"/>	Additional Article 80 Option(s)
<input type="checkbox"/>	One or more Supplement Process Options	
<b>B. Discussion of the Impact of Intervention Options on Displacement Risk</b> – To complete this section Proponent must reference specific answers provided throughout this form, as well as information from the <a href="#">Housing and Housing Composition Community Profile Report</a> which details the racial, ethnic, economic characteristics of the community within ¼ mile of the Proposed Project Site as well as the characteristics of the housing within the same radius, to discuss how selected intervention Options mitigate Displacement Risk. For more information on Displacement Risk throughout the City, Proponents should review the <a href="#">DND Displacement Risk Index and Maps</a> .		
Displacement Risk Analysis: Using the answers provided in <b>Section 4: Displacement Risk at the Proposed Project Site</b> the information provided in the Housing and Household Composition Community Profile Report and DND's Displacement Risk Index and Map, please discuss the displacement pressures at the Proposed Project Site and within the surrounding community and how the selected Intervention Options mitigate those pressures and create opportunities for members of protected classes. Please address how proposed Intervention Options are proportional to the size, scope, and impact of the Proposed Project on the surrounding community.	N/A - The site is currently the existing West End Library branch. No tenants have been and will be displaced from the property as it is a public library. The development aims to restore and strengthen the urban and social fabric of the West End by revitalizing a cherished community resource while creating much-needed affordable housing that is deeply connected to the local neighborhood.	
IDP Programming: Using the answers provided <b>Section 5: Inclusionary Development Policy (IDP)</b> and the information provided in the Housing and Housing Composition community Profile Report and DND's Displacement Risk Index and Map, describe how IDP	N/A - IDP is not applicable to the West End Library project because the project will be 100% affordable.	

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commitments will contribute to a more inclusive community, including how unit sizes and AMI targets meet the needs of residents in the surrounding community, especially members of protected classes.	
Please describe any additional efforts undertaken to address Displacement Risk at and within ¼ mile of the Proposed Project Site that have not already been discussed.	N/A
<b>C. Discussion of the Impact of Intervention Options on Historical Exclusion</b> – to complete this section Proponent must use the <a href="#">Historical Exclusion Map</a> to discuss how selected Intervention Options assure that the Proposed Project is an inclusive, integrated, and welcoming place and that the Proposed Project contributes to making the neighborhood more inclusive by creating opportunities for residency for members of protected classes, especially those that have been Historically Excluded	
Historical Exclusion Analysis: Using the Historical Exclusion map please discuss the factors contributing to Historical Exclusion surrounding the Proposed Project Site how the selected Intervention Options attempt to mitigate Historical Exclusion at the Proposed Project Site and are inclusive of members of protected classes.	The area surrounding the project site has experienced moderate levels of historic exclusion according to the HHCCP. By applying for project-based vouchers to deepen the affordability of units in the already fully affordable development will assist in providing opportunities for protected class households in the neighborhood. The development will provide family sized units, units that are accessible to households with disabilities, and new opportunities for voucher holders, mitigating any exclusion that families, residents with disabilities, and voucher holders have faced in the neighborhood.
Integration and Inclusivity: Considering the extent of Historical Exclusion surrounding the Proposed Project Site please discuss all efforts-including housing, commercial, and programmatic efforts-that will be taken to make the Proposed Project an inclusive, integrated, and welcoming place and how the Proposed Project will contribute to making the neighborhood more inclusive.	As a fully affordable development will be thoughtfully integrated into the neighborhood and will breathe new life into a cherished community resource, while addressing the urgent need for affordable housing. It will provide housing opportunities for Boston's lowest-income families in an area with strong economic potential, with convenient access to transit, healthcare, grocery stores, and essential services. The design and resident services foster meaningful connections among residents, local groups, and community resources. The library will serve as a vibrant hub for social interaction, learning, and community activities, while the new outdoor plaza will enhance neighborhood connectivity.
<b>D. Discussion of Marketing and Tenant Selection</b> – to complete this section the Proponent should reference how Marketing Intervention Options will be used and incorporated into occupancy and tenant selection policies in order to reach protected classes.	

## Article 80 - Affirmative Furthering Fair Housing Assessment Tool

Describe efforts that will be made to reach out to neighborhood residents-especially members of protected classes-when marketing residential units, keeping in mind language access and channels through which units are marketed.	POAH Communities will reach out agencies listed in the Affirmative Housing Marketing Plan (AHMP) when advertising. Each agency will receive a notification at least annually. POAH Communities uses TransPerfect to assist with language barriers.
Describe efforts that will be made to assure residential unit marketing will meet the requirements of the Fair Housing Act of 1968 and promote an inclusive and diverse community.	POAH Communities will reach out agencies listed in the Affirmative Housing Marketing Plan (AHMP) when advertising and will follow the Tenant Selection Plan, which includes the Fair Housing Act of 1968, when selecting applicants for tenancy.
For Proposed Projects anticipated to have rental units, describe tenant selection and occupancy policies regarding tenant eligibility (i.e.: use of CORI history, credit reports, eviction history, etc.), application fees, payment of first last/month rent and security deposits. <b>You may attach sample policies to complete this question.</b>	A copy of a sample Tenant Selection Plan is attached.

### Section 7: Attachments

Please indicated that the following attachments have been included with this form (\* indicates the attachment is required). If you are including attachments other than those listed here please describe the attachment.

1.	Housing and Household Composition Community Profile Report for Proposed Project Site*	<input checked="" type="checkbox"/>
2.	Condominium Conversion Notice to tenants (representative example)	<input type="checkbox"/>
3.	Vacant unit by vacancy date list	<input type="checkbox"/>
4.	Notice of intent to develop sent to Department of Neighborhood Development Office of Housing Stability	<input type="checkbox"/>
5.	Representative example of each notice sent to tenants about redevelopment at the Proposed Project Site	<input type="checkbox"/>
6.	Commercial tenant information	<input type="checkbox"/>
7.	Supplemental Process Option(s) description	<input type="checkbox"/>
8.	Sample tenant selection and occupancy policies	<input checked="" type="checkbox"/>
9.	Other (please describe): <b>Mayor's Executive Order</b>	<input checked="" type="checkbox"/>

### Section 8: Acknowledgements

## Article 80 - Affirmative Furthering Fair Housing Assessment Tool

By submitting this form, I acknowledge that the information provided is true and correct to the best of my knowledge and is subject to review by the Boston Interagency Fair Housing Development Committee (BIFDC) and that a recommendation by the BIFDC that AFFH strategies are appropriate for the Proposed Project must be made to the BPDA Board as part of seeking approval for the Proposed Project.

I further acknowledge that Intervention Options and other strategies for the meeting AFFH goals will be memorialized in Housing Agreements and/or Cooperation agreements which will restrict who may live in a particular unit of housing, how much rent may be charged for a particular unit of housing, the maximum sales price for a particular unit of housing, as allowed under local, state, and of federal laws.

I further acknowledge that some or all housing units shall be marketed in accordance with the policies and procedures established by the City of Boston's Affirmative Fair Housing Marketing Program and outlined in an Affirmative Fair Marketing Plan.

Kristel Salinas	Project Manager, POAH	January 3 <sup>rd</sup> , 2025
<b>Name</b>	<b>Title</b>	<b>Date</b>

**Housing and Household Composition Community Profile  
Report for the Proposed Project Site**

## HOUSING AND HOUSEHOLD COMPOSITION COMMUNITY PROFILE



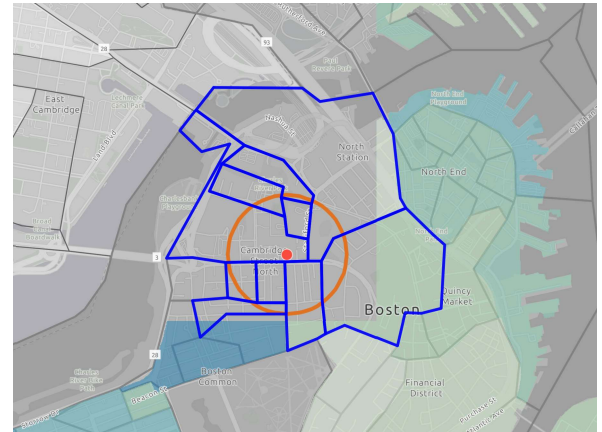
City of Boston  
Planning Department

## Housing and Household Composition Community Profile

Project Address: 151 Cambridge Street, Boston, Massachusetts, 02114

Total Households in Project Area: 6652

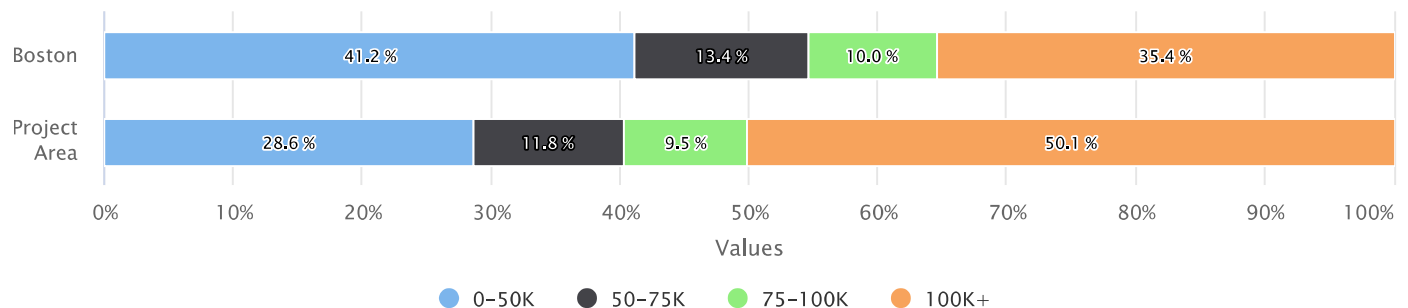
Historical Exclusion Level: Moderate



### Boston Household Characteristics

	Percent of Housing Units that are Renter Occupied	Percent of Households spending 30% or more of Household Income on rent	Percent of Households spending more than 50% of Household Income on rent	Percent of Housing Units that are Income-Restricted	Percent of Households Using Mobile Housing Vouchers, BHA
Project Area	74.8%	44.9%	19.7%	20.8%	1.7%
Boston	65.9%	48.9%	25.8%	20.6%	4.7%

### Household Income Buckets



### Household Composition Characteristics



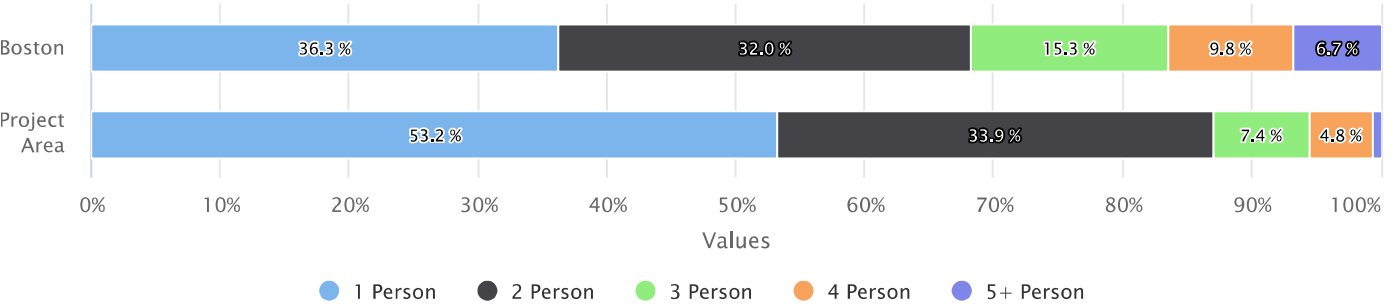
Housing and Household Composition Community Profile

Household Type	Married couple families	Other families	Non-family, householder living alone	Non-family, householder not living alone	Households with Children under 18	Households with a member with a disability
Project Area	25.9%	3.5%	53.2%	17.3%	9.9%	13.2%
Boston	28.0%	20.2%	36.3%	15.5%	22.4%	22.7%

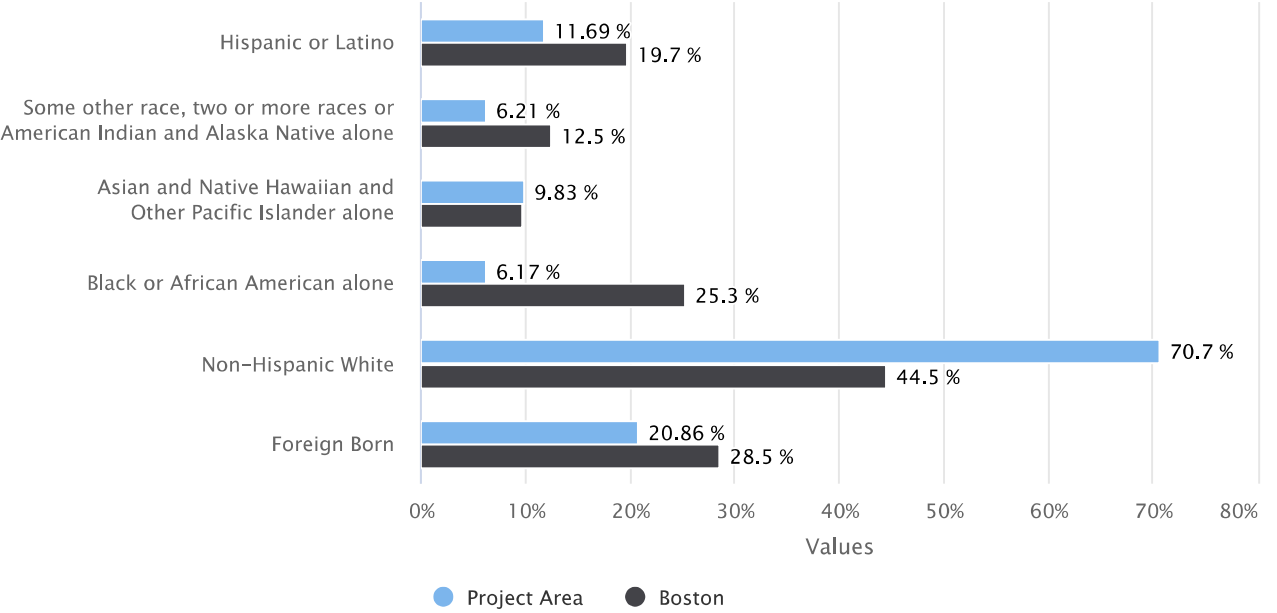
Unit Sizes

Mix of Units	Studio or 1-Bedroom	2-Bedroom	3-Bedroom	4+ Bedroom
Project Area	63.4%	30%	4.4%	2.2%
Boston	31.7%	34.6%	23.1%	10.7%

Household Size



Race and Ethnicity



This report was generated using publicly available American Community Survey data (except for mobile housing voucher data which is provided by the Boston Housing Authority) and is intended for informational purposes only.

## **Sample Tenant Selection Plan**



**TENANT SELECTION PLAN  
(with Affirmative Fair Housing Marketing Plan)**

**DEVELOPMENT NAME:**

**MassHousing No.**

**[A] INTRODUCTION**

This Tenant Selection Plan (the “Plan”) for  
(the “Development”), a unit multifamily housing development located at  
has been prepared by  
(the “Agent”), as the  
management agent for (“the Owner”).

The Plan sets out a procedure for processing and selecting applicants for subsidized units, including the establishment of preferences and priorities, occupancy standards, rejection standards, reviews and appeals of rejection decisions, and notice requirements.

**[B] APPLICABLE HOUSING ASSISTANCE PROGRAMS/REQUIREMENTS**

MassHousing Requirements. As a recipient of mortgage loan financing from the Massachusetts Housing Finance Agency (the “Agency” or “MassHousing”), the Plan is made subject to approval by MassHousing, and compliance with the Tenant Selection Regulations published by MassHousing, as such regulations may be amended from time to time. The Plan is further subject to, and incorporates in its entirety, the requirements set forth in the Tenant Selection Plan Reference Guide (the “TSP Reference Guide”) available in MassHousing’s Rental Portal Document Library, at [masshousingrental.com](http://masshousingrental.com), as may be amended from time to time. These requirements are collectively referred to as the “MassHousing Requirements.” Unless otherwise defined herein, all capitalized terms used herein shall have the meaning given such terms in the TSP Reference Guide.

Other Program Requirements. In addition, the Development is currently the recipient of rental housing subsidy under one or more subsidy programs, and is subject to applicable laws, regulations and guidelines (together with the MassHousing Requirements, the “Applicable Program Requirements”), as follows:



Federal Assistance (check all that apply)	State Assistance (check all that apply)
<input type="checkbox"/> Section 8 Rental Subsidy (Project Based Only)	<input type="checkbox"/> Massachusetts Rental Voucher Program (MRVP) (Project Based Only)
PHA/Contract Administrator:	Administering Agency:
Waiting List/Program Eligibility Determination: <input type="checkbox"/> Owner maintained <input type="checkbox"/> PHA maintained	Waiting List/Program Eligibility Determination: <input type="checkbox"/> Owner maintained <input type="checkbox"/> Administering Agency maintained
Type/Source (if known): <input type="checkbox"/> New Construction (Part 880) <input type="checkbox"/> Substantial Rehabilitation (Part 881) <input type="checkbox"/> Moderate Rehabilitation for SRO Dwellings (Part 882) <input type="checkbox"/> Housing Finance Agency (Part 883) <input type="checkbox"/> Section 515 Rural Projects (Part 884) <input type="checkbox"/> Loan Management Set Aside or Property Disposition (Part 886) <input type="checkbox"/> Project Based Vouchers (Part 983)  <input type="checkbox"/> Other: _____	<u>DHCD Subordinate Loan Programs</u> <input type="checkbox"/> HOME Investment Partnership Program* <input type="checkbox"/> Affordable Housing Trust Fund (AHTF) Program <input type="checkbox"/> Housing Stabilization Fund (HSF) Program * <input type="checkbox"/> Housing Innovation Fund (HIF) Program <input type="checkbox"/> Commercial Area Transit Node Program (CATNHP) * <input type="checkbox"/> Community Based Housing (CBH) Program <input type="checkbox"/> Capital Improvement and Preservation Fund (CIPF) * <input type="checkbox"/> Facilities Consolidation Fund (FCF) Program <input type="checkbox"/> Non-Federal Investment Trust Fund (NFIT) *
<input type="checkbox"/> Section 202	<input type="checkbox"/> Section 13A
<input type="checkbox"/> Section 236 (including 5-year post-maturity compliance period, if applicable)	<input type="checkbox"/> SHARP
<input type="checkbox"/> Rental Assistance Payments Program  <input type="checkbox"/> Rent Supplement Program	<b>Other Federal/State/Local Housing Assistance programs</b>
	<input type="checkbox"/> Low Income Housing Tax Credits  <input type="checkbox"/> HFA Risk Sharing Program  <input type="checkbox"/> FHA Mortgage Insurance (MAP or Other)
<b>NOTE:</b> For purposes of the Plan, a development participating in any of the above Programs are included within the definition of "Federally Assisted Housing" found in 24 CFR 5.100, and are subject under the Plan to requirements applicable to Federally Assisted Housing units.	Other: _____  <input type="checkbox"/> check here if program specific attachment is included)  * (DHCD Program Rider attached)



**[C] NONDISCRIMINATION AND AFFIRMATIVE FAIR HOUSING MARKETING PLAN**

In carrying out the Plan, the Agent shall not discriminate on the basis of race, color, religion, sex, national origin, genetic information, ancestry, sexual orientation, gender identity, age, familial status, children, marital status, veteran status or membership in the armed services, the receiving of public assistance, or physical or mental disability, or other basis prohibited by local, state or federal law in any aspect of tenant selection or matters related to continued occupancy. The Agent shall affirmatively market to minorities and persons with disabilities as specified in its Affirmative Fair Housing Marketing Plan (AFHMP) as approved by MassHousing and/or HUD, and attached to the Plan and incorporated herein as Attachment A. The Agent shall not discriminate based on race, national origin or another protected characteristic resulting from consideration of an applicant's limited ability to read, write, speak or understand English, or persons with limited English proficiency ("LEP"), either through the use of language-related criteria, or through a failure to provide housing-related language assistance services to persons with LEP.

**[D] FOR APPLICANT INFORMATION AND REASONABLE ACCOMMODATION REQUESTS:**

**AGENT:** \_\_\_\_\_ **PHONE:** \_\_\_\_\_  
**ADDRESS:** \_\_\_\_\_ **TDD:** \_\_\_\_\_  
\_\_\_\_\_ **FAX:** \_\_\_\_\_  
**ATTN:** \_\_\_\_\_ **WEBSITE:** \_\_\_\_\_  
**EMAIL:** \_\_\_\_\_

**[E] APPLICATIONS:** Applications, in the form(s) approved by MassHousing, shall be distributed and accepted in the manner(s) indicated below:

- ☐ In Person
- ☒ By Mail (required)
- ☐ By Fax
- ☐ By Electronic Submission

Applications shall be received and processed pursuant to applicable procedures in the TSP Reference Guide, as modified by any Applicable Program Requirements, provided that such Applicable Program Requirements shall not limit or subordinate applicability of (i) the MassHousing Required Preferences or the MassHousing Rejection Standards (Attachment B). If the Development includes Federally Assisted Housing units, applicant screening for such units shall include an Enterprise Income Verification (EIV) Existing Tenant Search, which shall be completed pursuant to Agent's policies for obtaining and using the EIV Existing Tenant Search Report (Attachment C). The form of application(s) approved by MassHousing for use with this Plan are attached (Attachment D). Unless the Development has been



specifically exempted from such requirement, every notice for rejection of an applicant shall include a copy of the MassHousing Conference Procedures (Attachment E).

The Development is exempt from the MassHousing Conference Procedures.

The Development is Federally Assisted Housing or has adopted the Bracketed Inserts found on the MassHousing Rejection Standards.

#### [F] DEVELOPMENT ELIGIBILITY REQUIREMENTS AND OCCUPANCY STANDARDS

**Square Footage:** Enter the average square foot range for each bedroom size.

**Occupancy Standards:** Enter the minimum and maximum number of occupants per bedroom size based on the average square footage for each unit type. The number of occupants per unit is subject to exception as may be required for Fair Housing compliance, reasonable accommodation or as permitted by a subsidy program. This includes consideration of household members that are expected to share a bedroom under DHCD Guidelines in determining the minimum number of occupants per bedroom in a unit with more than 1 bedroom.

**Unit Distribution:** Enter the Total Units for each bedroom size and then further identify the units by Program Type as identified in the controlling documents. **Note:** Total units by Program Type should be equal to the total number of units in the development including the unsubsidized market units.

**Income Eligibility:** Enter the applicable percentage area median income (AMI) limitation by Program Type

Average Square Footage – Bedrooms:	0-BR ____ sf	1-BR ____ sf	2-BR ____ sf	3-BR ____ sf	4-BR ____ sf	5-BR ____ sf	6-BR ____ sf	Total
Average Habitable Area per Unit	____ sf	____ sf	____ sf	____ sf	____ sf	____ sf	____ sf	
Minimum/Maximum Occupants	1/____	1/____	2/____	3/____	4/____	5/____	6/____	
<b>Total Units</b>								
Unsubsidized Market								
<b>Affordable Units</b>								
Section 8 ____ % AMI								
Section 236 ____ % AMI								
Section 13A ____ % AMI								
MRVP Project Based ____ % AMI								
Low Income Housing Tax Credits ____ % AMI								
Workforce Housing ____ % AMI								
Other: _____ ____ % AMI								
Other: _____ ____ % AMI								
Other: _____ ____ % AMI								
<b>DMH/DDS 3% priority Units</b>								





Occupancy is usually based on two people per bedroom unless the square footage allows or requires otherwise. A husband and wife, or those in a similar living arrangement, shall be required to share a bedroom, unless the consequence of sharing would be a severe adverse impact on his or her mental or physical health and the Agent receives reliable medical documentation as to such impact of sharing. Household size must comply with unit size based on the current State Sanitary Code Minimum Square Footage Requirements or any applicable Federal regulations or requirements.

### Massachusetts State Sanitary Code Minimum Square Footage Requirements

<u># Occupants</u>	<u>S.F. Per Bedroom*</u>	<u>Total Habitable Area*</u>
1	70 sq. ft.	150 sq. ft.
2	100 sq. ft.	250 sq. ft.
3	150 sq. ft.	350 sq. ft.

\*Square footage excludes bathrooms, connecting hallways, closets and laundry rooms.

Acceptance of a unit at maximum occupancy does not give the tenant the right to claim overcrowded conditions and request a transfer to a larger unit, unless the family size changes.

### [G] OCCUPANCY RESTRICTIONS (AGE/FAMILY STATUS)

The Development has been established as housing intended for older persons, and for which tenant selection and occupancy shall be restricted as permitted under exemptions provided under the Fair Housing Act, as amended (46 U.S.C. 3601 et seq.), and regulations promulgated thereto (24 CFR Part 100, Subpart E). **[indicate yes or no]:** \_\_\_\_\_

***[If yes, complete below as applicable]***

☐ Housing provided under Federal or State Program specifically designed and operated to assist elderly persons (see 24 CFR 100.302)

☐ The Development has adopted the HUD Title VI-D Elderly preference.

The number of units **set aside** at the Development for non-elderly disabled families is \_\_\_\_\_.

☐ The Development has adopted the “near-elderly disabled family” preference.

☐ OTHER: Specify Program and Restriction(s):

☐ 62 years of age and over - housing intended for, and solely occupied by, persons 62 years of age or older (see 24 CFR 100.303). If this designation is checked, the only persons eligible for occupancy of units in the Development are persons 62 years of age or older.



55 years of age and over – housing intended and operated for persons 55 years of age or older (*see* 24 CFR 100.304 et seq.). If this designation is checked, at least 80 percent of occupied units must be occupied by one person 55 years of age or older.

- ☐ All applicants for occupancy in the Development must be 55 years of age or older.
- ☐ At least one person in each applicant household for occupancy in the Development must be 55 years of age or older.
- ☐ Other (NOTE: attach policies and procedures specifying how minimum occupancy requirement will be maintained)

#### **PREFERENCES (MASSHousing STATUTORY, SECTION 236 PROGRAM AND OWNER-ADOPTED PREFERENCES)**

The Agent shall inform each applicant about available preferences, and provide an opportunity for each applicant to show that they qualify for available preferences.

1. Required MassHousing Preferences. The Agent shall apply preferences required under Section 7 of the MassHousing enabling statute (M.G.L. c. 23A App., Section 7) in determining the placement of an applicant on the waiting list. In applying such preferences, as more particularly defined in the TSP Reference Guide, the Agent shall use the following priority categories in descending order and shall document the sources of information obtained to verify qualification for preferences:

- (a) 1st Priority - Homelessness due to Displacement by Natural Forces.
- (b) 2nd Priority - Homelessness due to Displacement by Public Action (Urban Renewal).
- (c) 3rd Priority - Homelessness due to Displacement by Public Action (Sanitary Code Violations).
- (d) 4th Priority – Involuntary Displacement by Domestic Violence, Rape, Dating Violence, Sexual Assault or Stalking.

**Note: The Larger Household Preference, as required by DHCD Guidelines for inclusion of affordable housing units in the Subsidized Housing Inventory (SHI), is omitted here from the list of required preferences. This is to avoid unnecessary confusion because, with the application of the Occupancy Standards set forth in Section F, units will be sized to applicant households in such a manner that all households eligible to occupy a particular unit size will be of the highest preference category specified in the DHCD Guidelines, thereby eliminating the need for such a preference.**

2. HUD Section 236 Program - Required HUD Regulatory Preferences  
*[check as applicable - if checked, takes priority over any other preference set forth in the Plan]*



- ☐ The Development is receiving subsidy under the Section 236 Program, or otherwise remains subject to regulatory oversight under the Section 236 Program. Preference in the selection of applicants for a basic rent unit assisted under the Section 236 Program shall be given to applicants displaced as a result of:
- (i) government action, or
  - (ii) a Presidentially-declared disaster.
- ☐ The Development is also receiving Rental Assistance Payments, and the Agent shall apply secondary preferences (in descending order of priority), as follows:
- (i) Applicants eligible for Rental Assistance Payments;
  - (ii) Applicants eligible to pay less than the Section 236 “market rent” approved for the Development; and
  - (iii) Applicants with income sufficient to pay the Section 236 “market rent” approved for the Development.

3. Owner Adopted Preferences. The Agent shall apply Owner Adopted Preferences in determining the order of an applicant’s placement on the waiting list as may be allowed under applicable program rules. Unless otherwise indicated below, such preferences are subordinate to the required preferences set forth above and shall be applied in descending order as set forth below. ***[check and complete, as applicable]***

- (a) ☐ or applicants who seek relocation to avoid, remedy or address the harassment of a resident based on protected status, or the emergency transfer of a resident due to domestic violence, dating violence, sexual assault or stalking provided such applicants are: [check as appropriate]:

- ☐ current residents of housing either financed or administered by MassHousing;
- ☐ current residents of housing owned and operated by affiliates of the Owner and under control of the Agent;
- ☐ n/a – no limitation.

Documentation/Sources of Information required to Verify Qualification for Preference: The Agent shall obtain from the applicant such documentation as specified in 24 CFR 5.2007(b).

**NOTE – No HUD approval required for this preference.**

- (b) ☐ Preference Description:

Documentation/Sources of Information Required to Verify Qualification for Preference:



HUD Approval Required/Date Obtained: \_\_\_\_\_

- (c) ☐ Preference Description:

Documentation/Sources of Information Required to Verify  
Qualification for Preference:

HUD Approval Required/Date Obtained: \_\_\_\_\_

**[I] INCOME TARGETING (PROJECT BASED SECTION 8 ONLY)**  
***[check and complete, as applicable]***

1. Applicability of Mandatory Income Targeting:

- ☐ The Development contains \_\_\_\_ units receiving project-based Section 8 housing assistance payments, which are subject to Mandatory Income Targeting.

2. Allowance/Permission to Lease Assisted Units to Other than Very Low Income Families (check one):

- ☐ The assisted units in the Development were available for occupancy under a Section 8 HAP Contract effective before October 1, 1981, and are being leased on or after that date, in which case the assisted units may be leased to families whose income exceeds very low income but does not exceed low income. Pursuant to the HAP Contract, best efforts shall be used to lease not less than (\_\_\_\_%), or \_\_\_\_ [insert number of very low income units], of the assisted units to families whose income does not exceed very low income; the remaining (\_\_\_\_%) or \_\_\_\_ [insert number of low income units] of the assisted units shall be available to families whose income does not exceed low income, subject at all times to Mandatory Income Targeting requirements above.
- ☐ In accordance with 24 CFR 5.653(d)(3), the Development has received permission from HUD by letter dated \_\_\_\_\_ allowing the Development to lease up to \_\_\_\_% of the assisted units to low income tenants other than very low income families (attach approval letter), subject at all times to Mandatory Income Targeting requirements above.
- ☐ The Development has not received permission from HUD to lease assisted units to low income tenants other than very low income families.

3. Method to Comply with Income Targeting Requirements (check one):



- ☐ Method 1 – Admit only extremely low-income families until the 40% target is met.
- ☐ Method 2 – Alternate between the first extremely low-income applicant on the waiting list and the applicant at the top of the waiting list.
- ☐ Method 3 – Alternate between the first extremely low-income applicant on the waiting list and the applicant at the top of the waiting list in groups of 10.
- ☐ Other - \_\_\_\_\_  
\_\_\_\_\_ (specify methodology)

**[J] INITIAL RENT-UP/LOTTERY OR USE OF EXISTING WAITING LIST**

This Plan is authorized for use in the following *[check as applicable]*:

☐ Initial Rent-up/Lottery. The selection of residents for initial rent-up of the Development following completion of construction, or the re-occupancy of a significant number of housing units following the substantial rehabilitation of a development, and requires a lottery to establish an initial Waiting List from which selection of the initial residents shall be made.

☐ The lottery shall be conducted in accordance with any applicable state and federal guidelines for the administration of lotteries for multifamily affordable rental housing units, subject to applicable Fair Housing requirements, and with procedures developed by the Agent:

☐ (if completed) attached hereto as Attachment F (Procedures for Housing Lottery) as reviewed and approved by MassHousing and/or HUD.

☐ (if not completed) which shall be submitted to MassHousing for approval at least sixty (60) days prior to commencement of initial rent-up. These procedures, upon approval by MassHousing, shall be incorporated into this Plan as Attachment F (Procedures for Housing Lottery).

☐ Use of Existing Waiting List. The selection of residents for housing units utilizing an established waiting list for the Development in place as of the date of this Plan. In the event that any new preferences or priorities are required or adopted under this Plan, the Agent shall promptly notify all applicants on the waiting list and allow them the opportunity to provide evidence that they qualify for such preferences or priorities.

**[K] VACANCIES AND TRANSFERS OF EXISTING RESIDENTS**

In filling vacant units, the Agent shall (*select one*):



- ☐ offer current residents from the internal waiting list, **prior to** applicants on the external waiting list, the option to relocate to another unit in the Development, provided such residents meet the conditions of transfer found in the TSP Reference Guide, Section H.2.
- ☐ offer current residents from the internal waiting list, on alternating basis with applicants on the external waiting list, the option to relocate to another unit in the Development, provided such residents meet the conditions of transfer found in the TSP Reference Guide, Section H.2.
- ☐ offer current residents from the internal waiting list, on a rotating basis of \_\_\_\_\_ for every \_\_\_\_\_ person on the external waiting list, the option to relocate to another unit in the Development, provided such residents meet the conditions of transfer found in the TSP Reference Guide, Section H.2.

Priority in transfers of existing residents shall be given, in the order specified below, to:

- (a) residents requesting a transfer due to a reasonable accommodation request for a specific unit type; and
- (b) residents who are victims of harassment based on protected status, and those in need of an emergency transfer due to domestic violence, dating violence, sexual assault or stalking.
- (c) (List Other)
- (d) (List Other)

NOTE: Applicants who are eligible for an Owner Adopted Preference under Section H.3 above based upon relocation to avoid, remedy or address the harassment of a resident based on protected status, or the emergency transfer of a resident due to domestic violence, dating violence, sexual assault or stalking will be given priority for the specific unit type requested over anyone on the internal transfer list (except transfers relating to reasonable accommodation), subject at all times to the availability of, and qualification for, occupancy at comparable level of support under the same or similar housing subsidy program.

Emergency Transfer Plan [**check as applicable**]:

- ☐ The Development includes Federally Assisted Housing units, Low-Income Housing Tax Credit units, or such other units subject to Violence Against Women Reauthorization Act of 2013 (42 U.S.C. 14043e-11) and regulations promulgated in accordance therewith at 24 CFR Part 5, Subpart L, and the Owner has adopted, as required or voluntarily, an Emergency Transfer Plan (Attachment G) which is substantially in the form of the HUD Model Emergency Transfer Plan or otherwise satisfies the requirements of 24 CFR 5.2005(e).

**[L] ADDITIONAL POLICIES - USE OF PRIOR CRIMINAL HISTORY (OPTIONAL)**

\_\_\_\_\_ If checked, the Owner and Agent have adopted certain additional policies (Attachment H) relating to the receipt and use of prior criminal history in applicant screening, including the application of mitigating circumstances, in making determinations on suitability of applicants for tenancy. Such policies shall be applied by Agent, provided they are consistent with applicable law and do not alter or derogate from, the requirements of the Plan.





**[M] MISCELLANEOUS**

1. Modification of Tenant Selection Regulations. The Agent acknowledges that HUD or MassHousing may, from time to time, modify the requirements of their respective tenant selection regulations or policies. The Agent agrees that, upon reasonable notice, the Agent shall amend the Plan to satisfy such changes.
2. Review and Modification of Tenant Selection Plan. The Agent shall review periodically, but not less than once per calendar year, the Plan for compliance with the MassHousing Tenant Selection Regulations and Subsidy Program Requirements. The Agent may modify the Plan and the policies related to the selection of tenants at any time, subject to prior approval by MassHousing. The Agent shall send notice of the modification and a description of the changes made to the Plan to applicants on the waiting list within thirty (30) calendar days of the effective date of the modification. MassHousing may also require that the Agent, upon thirty (30) calendar days' notice, amend the Plan as directed by MassHousing. Any changes made in a Tenant Selection Plan shall be prospective unless otherwise required by MassHousing or applicable law.
3. Plan Available to Public Upon Request. The Agent shall make copies of the Plan available to the public, including Applicants and residents of the Development, upon request.

[The remainder of this page intentionally left blank.]



## CERTIFICATION/REQUEST FOR APPROVAL

As an authorized representative of the Agent, I have reviewed this plan and by signing below certify that the information contained herein is true and complete. The plan shall be effective as of the date approved by MassHousing (or, if later, the date Owner acquires the Development).

DEVELOPMENT NAME: \_\_\_\_\_

MASSHOUSING NO.: \_\_\_\_\_

AGENT: \_\_\_\_\_

By: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

APPROVED:

MASSACHUSETTS HOUSING FINANCE AGENCY

By: \_\_\_\_\_  
Anne Marie MacPherson, CPM, CPC  
Senior Manager of Asset Management

Date: \_\_\_\_\_

### **Attachments**

- Attachment A: Affirmative Fair Housing Marketing Plan
- Attachment B: MassHousing Rejection Standards
- Attachment C: Policy for Accessing and Using EIV (HUD programs only)
- Attachment D: Application for Occupancy (approved form)
- Attachment E: MassHousing Conference Procedures (if applicable)
- Attachment F: Procedures for Housing Lottery (if applicable)
- Attachment G: Emergency Transfer Plan (if applicable)
- Attachment H: Additional Policies - Use of Prior Criminal History (if Applicable)
- Attachment I: Request for Sex Offender Registry Information
- Attachment J: Consent for Release of Information
- Attachment K: Notification of Decision on Application
- Attachment L: Rejection Notice
- Attachment M: Annual Waiting List Update
- Attachment N: Notice of Removal from Waiting List
- Attachment O: Other (specify)



**ATTACHMENT A**

**APPROVED AFFIRMATIVE FAIR HOUSING MARKETING PLAN**

*[see attached]*



## ATTACHMENT B

### MASSHOUSING REJECTION STANDARDS Exhibit 2 to the Tenant Selection Regulations

An applicant and the applicant household shall be disqualified for a unit in a MassHousing administered or financed development for any of the following reasons:

- a) The applicant or a household member has disturbed a neighbor or neighbors in a prior residence by behavior, which, if repeated by a tenant in MassHousing administered or financed housing, would substantially interfere with the rights of other tenants to peaceful enjoyment of their units.
- b) The applicant or a household member has caused damage or destruction of property at a prior residence, and such damage or destruction of property, if repeated by a tenant in MassHousing administered or financed housing, would have a material adverse effect on the housing development or any unit in such development.
- c) The applicant or a household member has displayed living habits or poor housekeeping at a prior residence, and such living habits or poor housekeeping, if repeated by a tenant in MassHousing administered or financed housing, would pose a substantial threat to the health or safety of the tenant or other tenants or would adversely affect the decent, safe and sanitary condition of all or part of the housing.
- d) The applicant or a household member in the past has engaged in criminal activity, or activity in violation of M.G.L. c. 151B, §4, which, if repeated by a tenant in MassHousing administered or financed housing, would interfere with or threaten the rights of other tenants to be secure in their persons or in their property or with the rights of other tenants to the peaceful enjoyment of their units and the common areas of the housing development **[\*], or would threaten the health and safety of the owner or MassHousing, or any employee, contractor, subcontractor or agent of the owner or MassHousing who is involved in the housing development. Notwithstanding the foregoing, and pursuant the Violence Against Women Reauthorization Act of 2013 (42 U.S.C. 1403e-11) and regulations promulgated in accordance therewith at 24 CFR Part 5, Subpart L, admission to the development shall not be denied on the basis that the applicant or household member is or has been a victim of domestic violence, dating violence, sexual assault or stalking, as defined in the aforementioned regulations, if the applicant or household member otherwise qualifies for admission. \*]**
- e) The applicant or any household member who will be assuming part of the rent obligation has a history of non-payment of rent and such non-payment, if repeated by a tenant in MassHousing administered or financed housing, would cause monetary loss; provided, however, that if the applicant or household member paid at least 50% of his/her household's monthly income for rent each month during a tenancy but was unable to pay the full rent, an eviction for non-payment of the balance shall not disqualify such individual from housing pursuant to this paragraph. If the applicant or household members assuming part of the rent obligation are unable to provide a favorable prior landlord reference, the credit report of the applicant or



household member may be used to determine the applicant's ability to pay rent. In such circumstances, a bad credit history may be used as the basis of rejection, but the applicant may provide evidence of mitigating circumstances, which may include (i) a representative payer or reliable third party who would take responsibility for payment; (ii) evidence that such poor credit was a result of a disability that is now under control; or (iii) evidence that credit problems were the result of other circumstances that no longer exist and there is reason to believe that the applicant will now pay the rent promptly and in full. Lack of credit history, as opposed to poor credit history, is not sufficient justification to reject an applicant.

- f) The applicant or a household member has a history of failure to meet material lease terms or the equivalent at one or more prior residences, and such failure if repeated by a tenant of MassHousing administered or financed housing, would be detrimental to the housing development or to the health, safety, security or peaceful enjoyment of other tenants.
- g) The applicant has failed to provide information reasonably necessary for the housing provider to process the applicant's application.
- h) The applicant has misrepresented or falsified any information submitted as part of the applicant's application or a prior application submitted within the last three years, and the applicant fails to establish that the misrepresentation or falsification was unintentional.
- i) The applicant or a household member has directed abusive or threatening behavior which was unreasonable and unwarranted towards a management agent's employee during the application process or any prior application process within three (3) years.
- j) The applicant does not intend to occupy housing, if offered, as his/her primary residence.
- k) **[\* The applicant or household member has been evicted from federally assisted Housing for drug-related criminal activity, for three years from the date of eviction; provided, however, that if the evicted applicant or household member who engaged in drug-related criminal activity has successfully completed a supervised drug rehabilitation program or circumstances leading to the eviction no longer exist (for example, the criminal household member has died or is imprisoned), the owner may, but is not required to, admit the household. \*]**
- l) The applicant or household member is a current illegal user of one or more controlled substances as defined in M.G.L. c. 94C §1 **[\* or by applicable federal law]**. A person's illegal use or possession of a controlled substance within the preceding twelve months shall create a presumption that such person is a current illegal user of a controlled substance, but the presumption may be overcome by a convincing showing that the person has permanently ceased all illegal use of controlled substances. This disqualification of current illegal users of controlled substances shall not apply to applicants for housing provided through a treatment program for illegal users of controlled substances.
- m) **[\* There is reasonable cause to believe that the applicant or household member's illegal use of a drug may interfere with the health, safety or right to peaceful enjoyment of the premises by**



other residents. Examples of evidence of illegal activities may include a conviction record, former landlord references, etc.) \*]

- n) [\* The applicant or household member is subject to registration with the Massachusetts Sex Offender Registry Board pursuant to M.G.L. c. 6 Section 178C et seq., or a lifetime registration requirement under any state sex offender registration program. \*]
- o) [\* There is reasonable cause to believe that the applicant or household member's abuse or pattern of abuse of alcohol may interfere with the health, safety or right to peaceful enjoyment of the premises by other residents. \*]

**\*Note:** Bracketed Inserts are required criteria for admission to Federally Assisted Housing developments, but may be adopted by non-federally assisted MassHousing developments at the option of the Owner and Agent. If the Owner and Agent elect to adopt any or all of the bracketed inserts for a non-federally assisted MassHousing development, they must do so consistently with respect to all applicants.



## **ATTACHMENT C**

### **APPROVED POLICIES FOR ACCESSING AND USING EIV EXISTING TENANT SEARCH REPORT DURING TENANT SELECTION SCREENING**

Only approved EIV System Users may access the Existing Tenant Search Report in HUD's Web Access secured System (WASS). However, the report may be viewed by either an approved EIV System User or Non-System User. Both types of users are required to complete a Security Awareness Training program that covers HUD's Security Requirements and the Privacy Act of 1974 as amended.

In accordance with HUD regulations, an executed Form HUD 9887 is not required to access the EIV Existing Tenant Search Report.

At the time of application processing, the Existing Tenant Search Report will be viewed in EIV to determine if the applicant or any applicant household member is currently residing at another location in HUD's Multi-Family (MF) or Public and Indian Housing (PIH) divisions.

Both the HUD MF Tenant Rental Assistance Certification System (TRACS) and PIH's Information Center (PIC) databases will be queried in EIV at the time the search is conducted.

Prior to scheduling the applicant interview, each applicant household member will be searched using his/her social security number (SSN). The report/s will be printed and securely retained with the application during application processing.

If the Existing Tenant Search Report identifies the applicant or any applicant household member is receiving rental assistance in another location, the information contained in the report will be addressed with the household member. The household member will be given an opportunity to explain any circumstances relative to his/her being assisted at the other location.

The applicant household member may be approved for admission to the Development, as permitted by HUD rules, in cases where the applicant wants to move from his/her existing location or where two assisted families share custody of a minor child. In such cases, written correspondence will be conducted to follow up with the respective PHA or owner/agent of the existing location to confirm the individual's program participation status prior to admission, including the coordination of move-in/move-out dates and the termination of HUD assistance to the applicant household member/s at the existing location prior to occupancy at the Development.

Conversely, if the Existing Tenant Search Report identifies the applicant or any applicant household member is not receiving assistance at another location, the report/s will be printed and retained with the application during application processing.

Once approved for occupancy at the Development, the report/s and any written correspondence pertaining to the report/s will be securely retained in the tenant file for the entire term of tenancy plus three years upon move-out. After the three-year period has expired, disposal of the EIV Existing Tenant Search Report is in accordance with the Agent's policy for document disposal.





**ATTACHMENT D**

**APPROVED FORM OF APPLICATION**

*[see attached]*



## ATTACHMENT E

### MASSHOUSING CONFERENCE PROCEDURES

- ☐ Option: The Agent will provide a pre-conference meeting with the applicant to resolve issues before formally offering a conference.(Define procedures below.)

The following conference procedure is to be made available to applicants to MassHousing-financed developments who are rejected or reclassified to a lower tenant-selection priority category.

1. THE TIME FOR REQUESTING A CONFERENCE:

An applicant who wishes to contest the rejection of his or her application or reclassification to a lower tenant-selection preference category must request a conference within five (5) business days from the applicant's receipt of the notice of rejection or reclassification.

2. THE APPLICANT'S REQUEST:

The request for a conference must be made in writing, or in an alternative format necessary because of a disability, to the development's management agent (the Agent). It may be mailed or delivered by hand. The Agent must immediately notify MassHousing's General Counsel by mail or electronic mail of the applicant's request.

3. MASSHOUSING'S APPOINTMENT OF CONFERENCE OFFICER AFTER RECEIVING APPLICANT'S REQUEST:

Within three (3) business days of receipt of applicant's request from the Agent, MassHousing shall appoint an impartial conference officer and notify the Agent and the applicant thereof, in alternate format if necessary.

4. SETTING UP THE CONFERENCE:

The conference officer shall establish a mutually convenient date and place to hold the conference, but in no event will the conference be held later than twenty (20) days from the date of the written rejection notice unless otherwise agreed to by the applicant, the Agent and the General Counsel of MassHousing. The Agent shall make any necessary reasonable accommodations, such as a sign language interpreter. Failure of an applicant to appear on the scheduled conference date will result in a decision upholding the Agent's rejection of the application.



5. THE CONFERENCE:

The conference is an informal proceeding intended to determine whether the Agent's rejection of an applicant or reclassification of an applicant's selection priority is reasonable in light of the evidence presented. At the conference, it is the Agent's burden to present evidence in support of its decision, but the rules of evidence applicable in a court of law shall not apply. Both the Agent and the applicant are permitted, but not required, to have a representative or advocate present during the conference proceedings. Generally, conference proceedings will be limited to one half hour in length and each party should be prepared to present its case within the time allotted.

6. THE DECISION OF THE CONFERENCE OFFICER:

The conference officer must determine whether the Agent reasonably rejected or reclassified the applicant in accordance with the selection criteria, program requirements and/or MassHousing policies. The conference officer's decision must be in writing, and, if necessary, in an alternate format, must be dated, and must state his or her findings of fact and the basis for his or her decision. Unless the parties mutually agree otherwise, the conference officer shall only consider evidence presented at the conference. A copy of the conference officer's decision will be forwarded within five (5) business days of the conference to the Agent and the applicant.

7. APPEAL OF CONFERENCE OFFICER'S DECISION:

The decision of the conference officer may be appealed to the General Counsel within five (5) business days of receipt of the decision. The appealing party (appellant) must simultaneously notify the Agent of the appeal and provide copies of any statement submitted in support of such appeal. The Agent may submit a response to the appeal within three (3) business days. In determining whether to uphold or overturn the conference officer's decision, the General Counsel will consider only the evidence presented at the conference, unless the Agent and the applicant agree to supplement the record. The General Counsel's decision will be in writing or in an alternate format, if necessary, and will state the specific reasons for his or her decision. A copy in alternate format, if necessary, of the decision will be forwarded to both the Agent and the applicant within eight (8) business days of the request for an appeal.

8. WAIVER OF TIME LIMITS:

For good cause shown, MassHousing may in its discretion waive any of the applicable time limits stated herein.



**ATTACHMENT F**

**PROCEDURES FOR HOUSING LOTTERY**

*[see attached, if applicable]*



**ATTACHMENT G**

**EMERGENCY TRANSFER PLAN**

*[see attached, if applicable]*



## **Mayor's Executive Order**



## City of Boston Affordable Housing Acceleration Certificate

*This form certifies that the project described below qualifies as an affordable housing project eligible for prioritized approval, as described in Mayor Michelle Wu's Executive Order Relative to Speeding the Production of Affordable Housing, dated October 6, 2022. This form does not substantiate city endorsement, public support and/or public subsidy.*

### Project Information:

Project Name: West End Library (Housing with Public Assets)

Project Address: 151 Cambridge ST, Central, MA, 02114

Primary Parcel ID: 0300656000

Project Type: New Construction

Neighborhood: Central

Council District: 8

Proposed Restricted Unit Count (60% of units at 100% AMI or below): 100%

### Developer Information:

Developer Name: Preservation of Affordable Housing POAH, LLC

Primary Contact: Meena Jacob

Address: 2 Oliver Street, Suite 500 Boston, MA 02109

Phone: 617-449-0895

Email: mjacob@poah.org

### Certification Information:

*Developers should include a copy of this certificate in all formal project review filings at the City of Boston, including applications for building permits, Article 80 filings, and appeals for zoning relief. All city departments reviewing projects with this certificate are instructed to provide this project priority status in any upcoming review processes or meeting schedules. As described in the executive order, projects must have at least 60% of their units income-restricted at or below 100% of Area Median Income (AMI) to be eligible for prioritized review and approval.*

*This certificate is only applicable for the unit distribution described above. Developers are responsible for notifying the Mayor's Office of Housing of any program updates that may impact eligibility. Developers are required to submit complete and timely applications, fulfill all administrative requirements, and provide prompt feedback and availability to city departments. Failure to do so may lead to the certificate being revoked. Certification may also be revoked or re-certification may be required based on changes to project affordability levels.*



Mayor's Office  
of Housing



boston planning &  
development agency



EOID: EO2422

*For questions regarding this certificate, please contact your MOH development officer, **Joe Backer** at [joseph.backer@boston.gov](mailto:joseph.backer@boston.gov).*

Signed by: Christine A. O'Keefe  
 MOH Staff Signature: 6E88D3488F0B4BA...

Name: Christine A. O'Keefe Date: 10/9/2024

Signed by: Reuben Kantor  
 BPDA Staff Signature: 555CA62EA9C44DA...

Name: Reuben Kantor Date: 10/9/2024

Signed by: Meena Jacob  
 Developer Signature: E76A38669A944B7...

Name: Meena Jacob Date: 10/10/2024



Mayor's Office  
of Housing



## **Appendix F – Wind Analysis**

# FINAL REPORT



## WEST END LIBRARY

BOSTON, MA

PEDESTRIAN WIND STUDY

RWDI # 2409479

December 23, 2024

### SUBMITTED BY

**Preservation of Affordable Housing, Inc.**  
2 Oliver Street, Suite 500  
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### SUBMITTED BY

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## EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed West End Library in Boston, MA (Image 1). The potential wind conditions have been assessed based on wind-tunnel testing of the project under the No Build and Build configurations (Images 2A and 2B), and the local wind records (Image 3) and compared to the Mean Speed and Effective Gust criteria adopted by the Boston Planning and Development Agency (BPDA). The results of the assessment are shown on site plans in Figures 1A through 2C, and the associated wind speeds are listed in Tables 1 and 2. The key findings are summarized as follows:

### Effective Gust

- The effective gust criterion will not be exceeded on an annual and seasonal basis in both the No Build and Build configurations.

### Mean Speed

- No dangerous mean speeds are predicted for either of configurations assessed on an annual and seasonal basis.
- Existing wind conditions in the No Build Configuration are comfortable for the intended pedestrian usage on and around the site on an annual basis.
- In the Build Configuration, wind conditions at most locations are expected to be similar to those in the No-Build Configuration, with slightly elevated wind conditions that remain comfortable for pedestrian use around the southeast corner of the proposed building during the summer.



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# 1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed West End Library in Boston, MA. This report presents the project objectives, background and approach, and discusses of the results from RWDI's assessment.

## 1.1 Project Description

The project (site shown in Image 1) is located between Cambridge Street and William Cardinal O'Connell Way on the west side of Staniford Street. The proposed building will be 165 ft tall, consisting of a 12-story residential building with a two-story library on the first two levels and an outdoor amenity area on the 5<sup>th</sup> level.

## 1.2 Objectives

The objective of the study was to assess the effect of the proposed development on local conditions in pedestrian areas on and around the study site and provide recommendations for minimizing adverse effects, if needed. This quantitative assessment was based on wind speed measurements on a scale model of the project and its surroundings in one of RWDI's boundary-layer wind tunnels. These measurements were combined with the local wind records and compared to appropriate criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian areas, including building entrances, public sidewalks and walkways, and outdoor amenity areas.



Image 1: Aerial View of Site and Surroundings (Photo Courtesy of Google™ Earth)





## 2 BACKGROUND AND APPROACH

### 2.1 Wind Tunnel Study Model

To assess the wind environment around the proposed project, a 1:300 scale model of the project site and surroundings was constructed for the wind tunnel tests of the following configurations:

- A – No Build: Existing site with existing surroundings (Image 2A), and,
- B – Build: Proposed project with existing surroundings (Image 2B).

The wind tunnel model included all relevant surrounding buildings and topography within an approximately 1200 ft radius of the study site. The wind and turbulence profiles in the atmospheric boundary layer beyond the modelled area were also simulated in RWDI's wind tunnel. The wind tunnel model was instrumented with 52 specially designed wind speed sensors to measure mean and gust speeds at a full-scale height of approximately 5 ft above local grade in pedestrian areas throughout the study site. Wind speeds were measured for 36 directions in a 10-degree increment. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the mean wind speed at a reference height above the model. The placement of wind measurement locations was based on our experience and understanding of the pedestrian usage for this site.

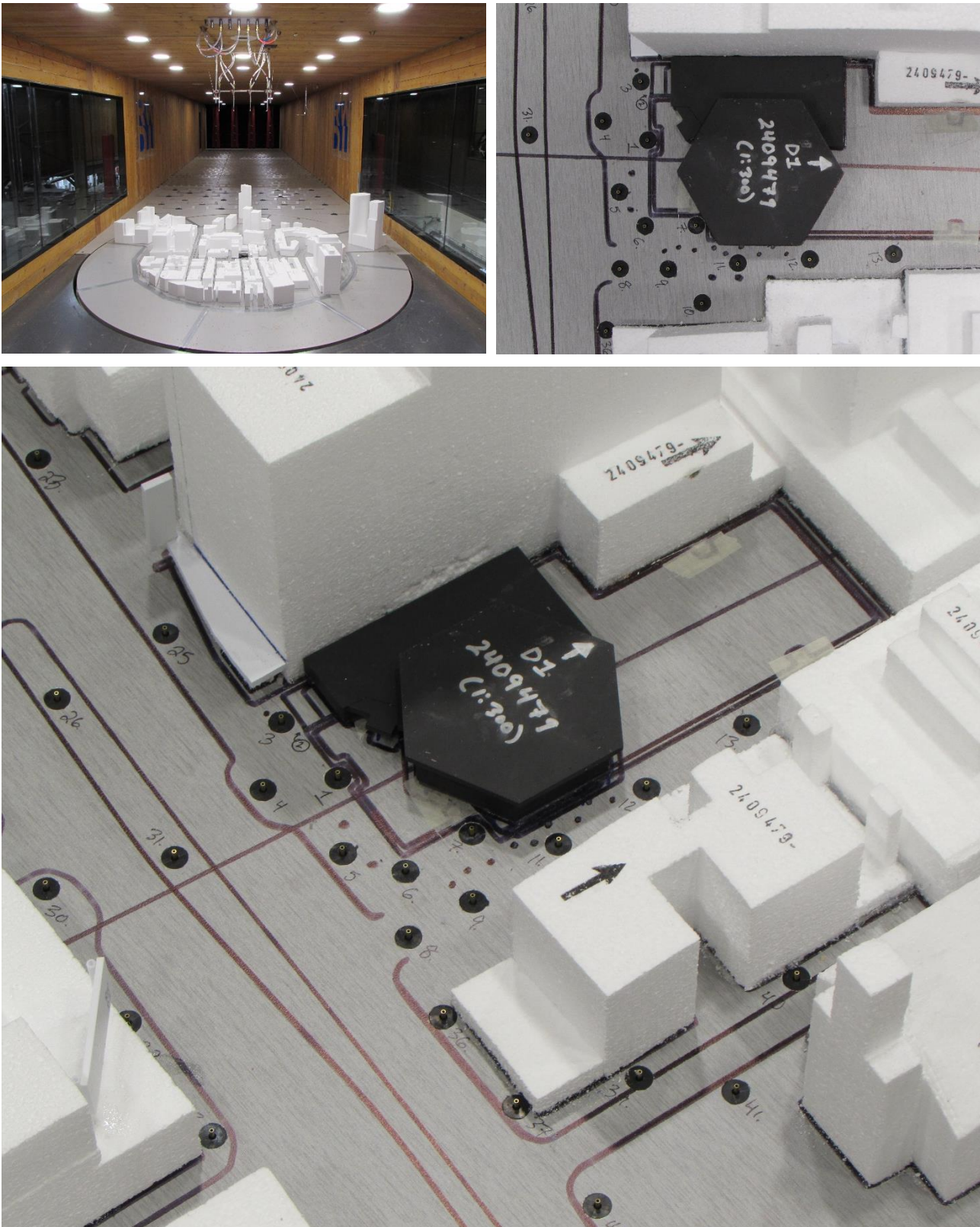


Image 2A: Wind Tunnel Study Model – No Build Configuration



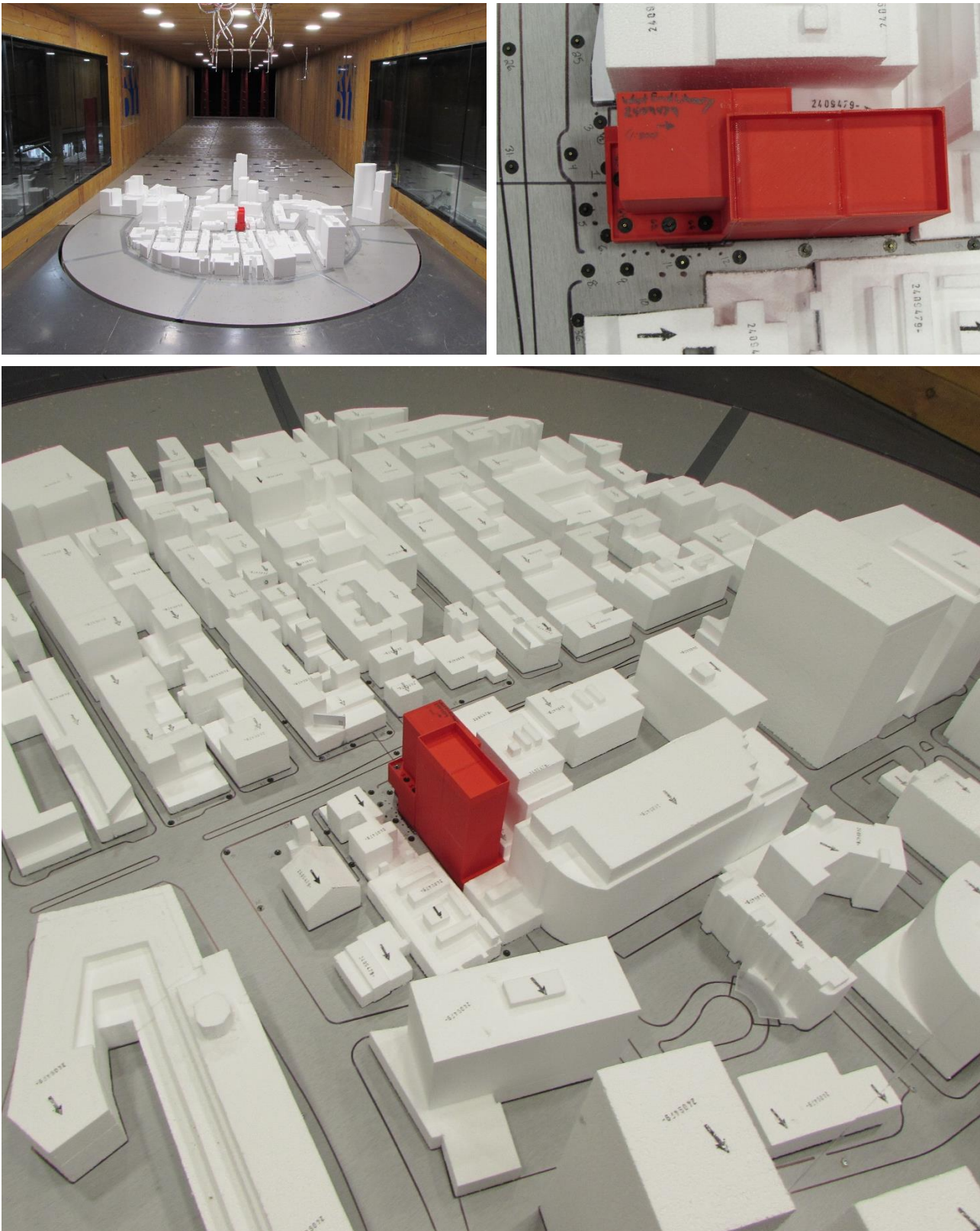
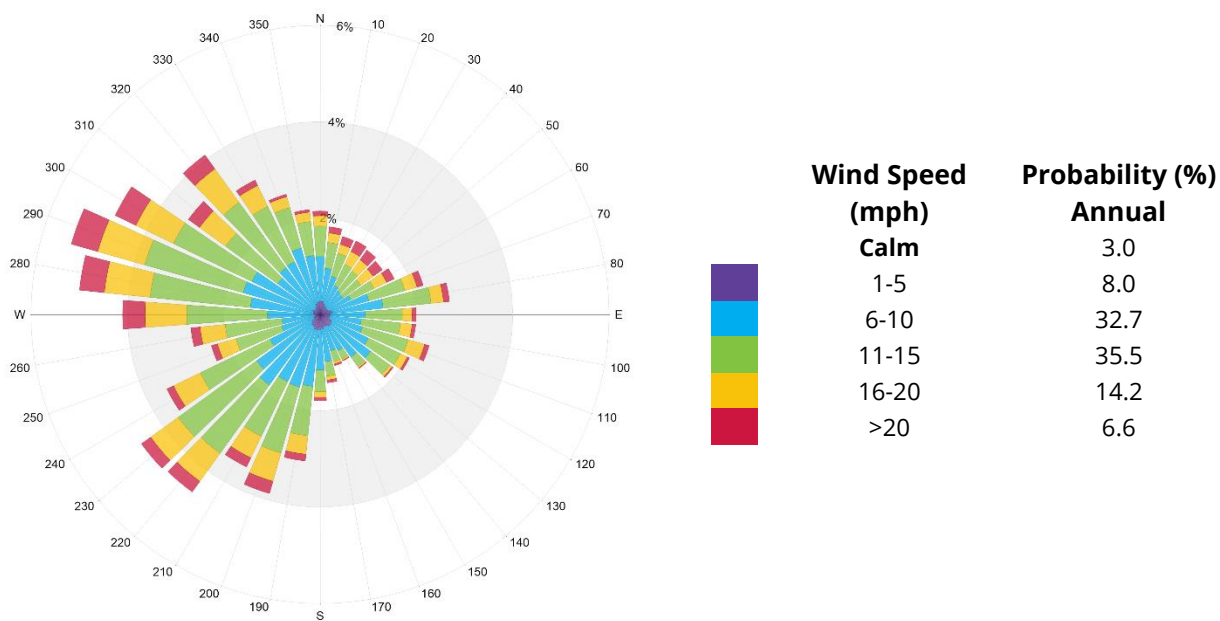


Image 2B: Wind Tunnel Study Model – Build Configuration

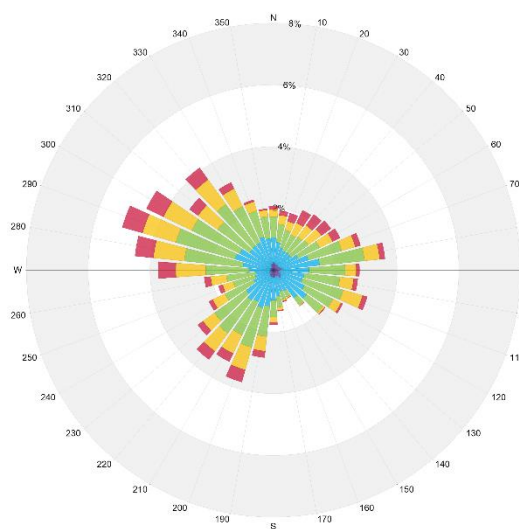
## 2.2 Meteorological Data

The data from the wind tunnel tests was combined with long-term meteorological data recorded during the years 1995 through 2023 at Boston Logan International Airport to predict full scale wind conditions. The analysis was performed separately for the entire year and for each of the four seasons. Images 3 and 4 present "wind roses", summarizing the annual and seasonal wind climates in the Boston area, respectively, based on the data from Logan Airport.

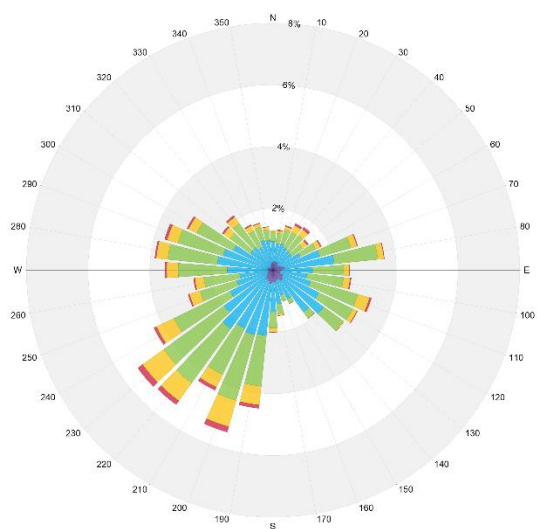
On an annual basis, the most common wind directions are those between north-northwest and south-southwest. Winds from the east-northeast to the east-southeast are also relatively common. In the case of strong winds, west-northwest, northwest, west and northeast are the dominant wind directions. A similar directional distribution is seen in the seasonal wind roses as well (Image 4).



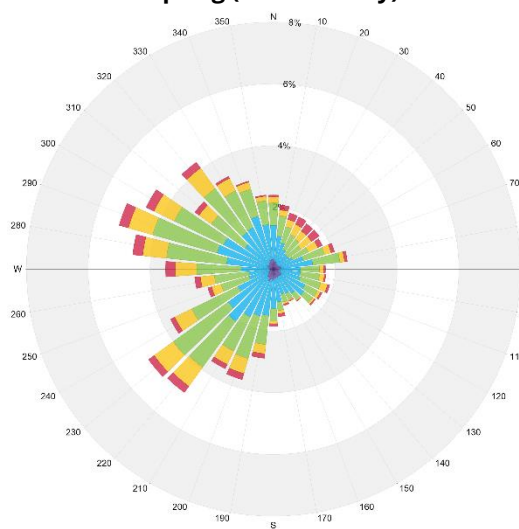
**Image 3: Annual Directional distribution of winds approaching Boston Logan International Airport from 1995 through 2023**



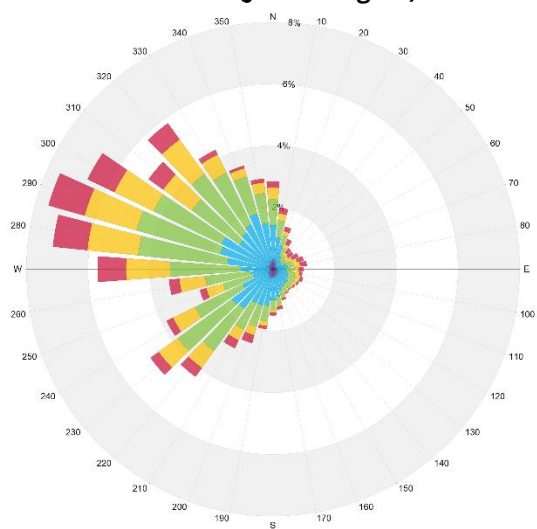
Spring (March – May)



Summer (June – August)



Fall (September – November)



Winter (December – February)

	Wind Speed (mph)	Probability (%)			
		Spring	Summer	Fall	Winter
	Calm	2.7	3.1	3.4	2.7
	1-5	6.8	9.6	8.7	6.8
	6-10	28.7	39.0	34.9	28.4
	11-15	36.0	36.7	34.8	34.5
	16-20	17.2	9.7	12.7	17.1
	>20	8.6	1.9	5.6	10.4

Image 3: Seasonal Directional Distribution of Winds Approaching Boston Logan International Airport from 1995 through 2023

## 2.3 BPDA Wind Criteria

The Boston Planning and Development Agency (BPDA) has adopted two standards for assessing the relative wind comfort of pedestrians. First, the BPDA wind design guidance criterion states that an effective gust velocity (hourly mean wind speed +1.5 times the root-mean-square wind speed) of 31 mph should not be exceeded more than 1% of the time.

The second set of criteria used by the BPDA to determine the acceptability of specific locations is based on the work of Melbourne. This set of criteria is used to determine the relative level of pedestrian wind comfort for activities such as sitting, standing, or walking. The criteria are expressed in terms of benchmarks for the 1-hour mean wind speed exceeded 1% of the time.

Wind Acceptability	Effective Gust Speed (mph)
Acceptable	$\leq 31$
Unacceptable	$> 31$
Comfort Category	Mean Wind Speed (mph)
Comfortable for Sitting	$< 12$
Comfortable for Standing	$\leq 15$
Comfortable for Walking	$\leq 19$
Uncomfortable for Walking	$> 19$
Dangerous	$> 27$
**Effective gust and mean wind speeds are based on a 1% exceedance or 99 percentile wind speeds.	

The consideration of wind in planning outdoor activity areas is important since high winds in an area tend to deter pedestrian use. For example, winds should be light or relatively light in areas where people would be sitting, such as outdoor cafes or playgrounds. For bus stops and other locations where people would be standing, somewhat higher winds can be tolerated. For frequently used sidewalks, where people are primarily walking, stronger winds are acceptable. For infrequently used areas, the wind comfort criteria can be relaxed even further. The actual effects of wind can range from pedestrian inconvenience, due to the blowing of dust and other loose material in a moderate breeze, to severe difficulty with walking due to the wind forces on the pedestrian.

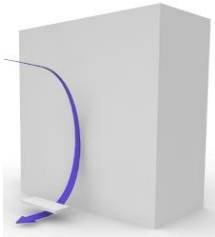
The wind climate found in a typical downtown location in Boston is generally comfortable for the pedestrian use of sidewalks and thoroughfares and meets the BPDA effective gust velocity criterion of 31 mph. However, without any mitigation measures, this wind climate is likely to be frequently uncomfortable for more passive activities such as sitting.

This study involved state-of-the-art measurement and analysis techniques to predict wind conditions. Nevertheless, some uncertainty remains in predicting wind comfort, and this must be kept in mind. For example, the sensation of comfort among individuals can be quite variable. Variations in age, individual health, clothing, and other human factors can change a particular response of an individual. The comfort limits used in this report represent an average for the total population. Also, unforeseen changes in the project area, such as the construction or removal of buildings, can affect the conditions experienced at the site. Finally, the prediction of wind speeds is necessarily a statistical procedure. The wind speeds reported are for the frequency of occurrence stated (1% of the time). Higher wind speeds will occur but on a less frequent basis.



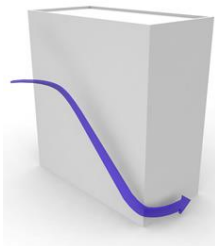
## 2.4 Generalized Wind Flows

In our discussion of wind conditions, reference may be made to the following generalized wind flows (Image 5):



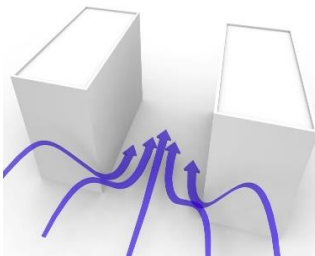
### ***DOWNWASHING***

Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level. This is often the main cause for wind accelerations around large buildings at the pedestrian level.



### ***CORNER ACCELERATION***

When winds approach at an oblique angle to a tall façade and are deflected down, a localized increase in the wind activity or corner acceleration can be expected around the exposed building corners at pedestrian level.



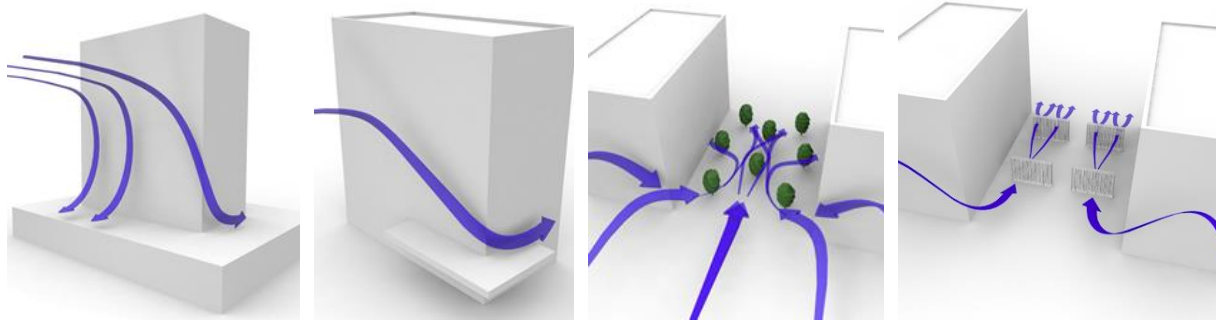
### ***CHANNELING EFFECT***

When two buildings are situated side by side, wind flow tends to accelerate through the space between the buildings due to channeling effect caused by the narrow gap.

**Image 5: Generalized Wind Flows**

If these building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity. Design details such as setting back a tall tower from the edges of a podium, deep canopies close to ground level, wind screens, tall trees with dense landscaping, etc. (Image 6) can help reduce wind speeds. The choice and effectiveness of these measures would depend on the exposure and orientation of the site with respect to the prevailing wind directions and the size and massing of the proposed buildings.

### ***Podium/tower setback, canopy, landscaping and wind screens (left to right)***



**Image 6: Common Wind Control Measures**



## 3 RESULTS AND DISCUSSION

The predicted wind conditions in terms of mean and effective gust speeds pertaining to the tested configurations are graphically depicted on site plans in Figures 1A through 2B located in the “Figures” section of this report. These conditions and the associated wind speeds are presented in Tables 1 and 2, located in the “Tables” section of this report.

Wind speeds that meet the Effective Gust Criterion are anticipated at all locations on an annual and seasonal basis in both the No Build and Build configurations. Furthermore, no wind speeds that are considered to be ‘Dangerous’ are detected at any location on an annual or seasonal basis for both the No Build and Build configurations.

The following summary of pedestrian wind comfort, based on the annual winds for each configuration tested, includes a detailed discussion of the suitability of the predicted wind comfort conditions for the anticipated pedestrian use of each area of interest. Wind conditions comfortable for walking are appropriate for sidewalks and walkways as pedestrians will be active and less likely to remain in one area for prolonged periods of time. Lower wind speeds conducive to standing are preferred at main entrances where pedestrians are apt to linger. Typically, the summer winds tend to be more comfortable than the annual winds while the winter, spring, and fall winds are less comfortable than the annual winds, which is considered appropriate.

### 3.1 No Build Configuration

Mean speed winds for the existing site are comfortable for the intended pedestrian use, with most areas experiencing sitting on an annual basis (Figure 1A). These calm wind speeds can be attributed to the built-up surrounding environment that helps shelter the project site from prevailing winds.

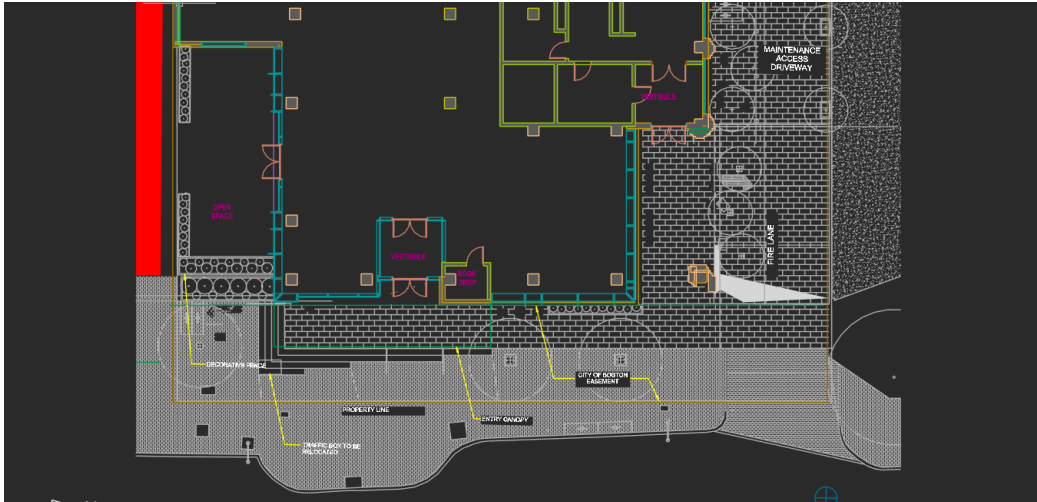
### 3.2 Build Configuration

#### 3.2.1 Grade Level (Locations 1 through 48)

With the addition of the proposed building to the site, wind conditions at the main entrances, situated near Locations 1 and 7 in Figures 1B, are expected to be comfortable for sitting on an annual basis, which is considered suitable for entrances where pedestrians are apt to linger.

In general, wind conditions similar to the mean speeds of the No Build Configuration are anticipated at most locations on and around the proposed development. Winds suitable for sitting or standing are expected at most locations, while slightly higher wind speeds, appropriate for walking, are anticipated at a few locations, particularly around the southeast corner of the building. Uncomfortable conditions for walking are also predicted near the southeast corner of the building (see Location 6 in Figure 1B). On a seasonal basis, calmer wind speeds near the corner are predicted, with conditions comfortable for walking (see Table 2).

It may be noted that landscaping was not included in the baseline wind tunnel testing (as is the norm for these assessments) and that the proposed landscaping is expected to help reduce wind speeds near the corner when foliage is present (see landscaping plan in Image 7)



**Image 7: Landscaping elements at grade level**

### 3.2.2 Outdoor Amenity at Level 5 (Locations 49 through 52)

Wind speeds comfortable for sitting or standing are ideal during the summer for areas intended for passive activities, such as plaza spaces or outdoor dining areas.

On the level 5 amenity area, the annual mean wind speeds are anticipated to be comfortable for sitting at most locations which is appropriate for passive use. The lone exception is near the southeast corner of the amenity area where wind speeds are predicted to be comfortable for walking on an annual basis (Location 50 in Figure 1B). Positively, calmer wind speeds comfortable for sitting are expected in the summer at this location when the amenity space is expected to be used most frequently (see Table 2). Thus, the higher wind speeds in the shoulder and winter seasons may be not of concern due to reduced patron usage.

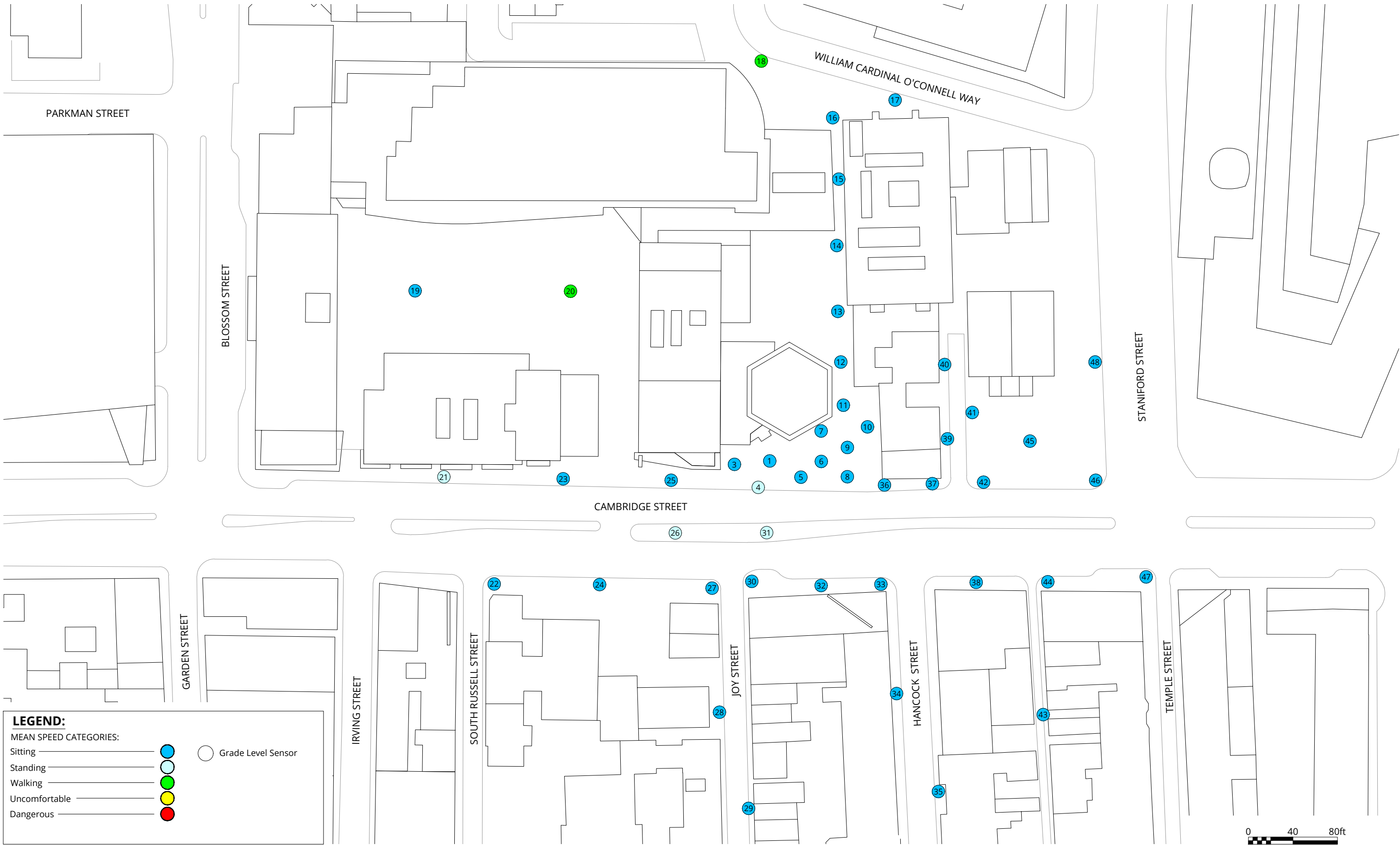


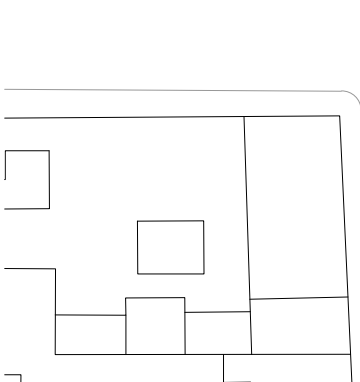
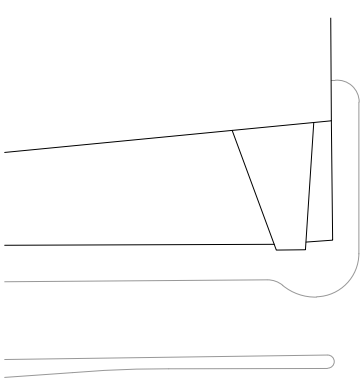
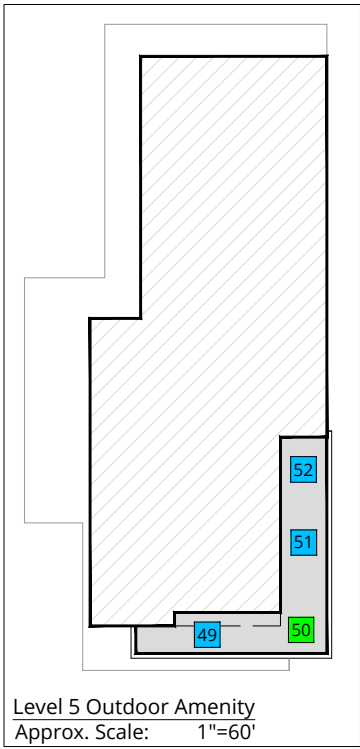
## 4 APPLICABILITY OF RESULTS

The wind conditions presented in this report pertain to the model of the West End Library constructed using the drawings and information listed below. Should there be any design changes that deviate from this list of drawings, the wind condition predictions presented may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

File Name	File Type	Date Received (dd/mm/yyyy)
241101 - WEL GF Plan	CAD	01/11/2024
241101 - WEL Site Plan	CAD	01/11/2024
241102- WEL Massing	Rhino 3D	01/11/2024

# FIGURES

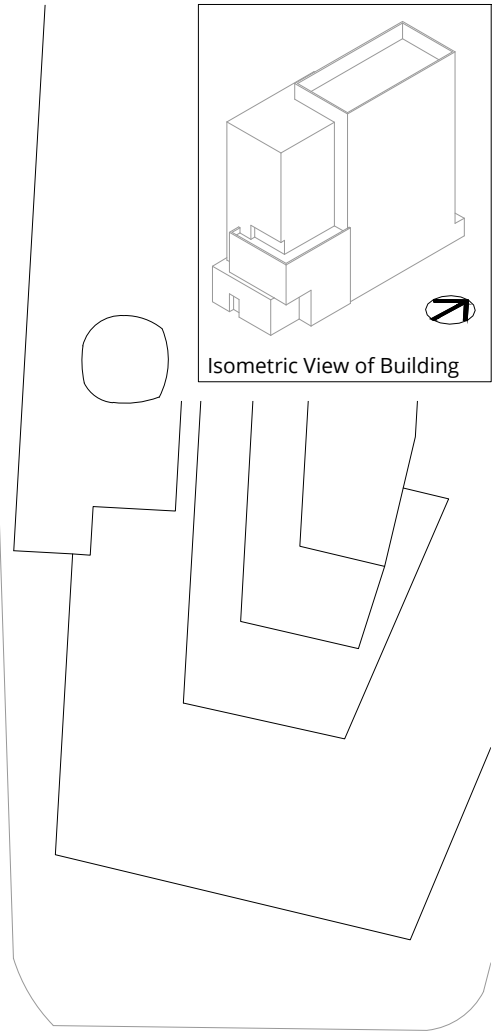




**LEGEND:**

MEAN SPEED CATEGORIES:

Sitting			Grade Level Sensor
Standing			Terrace Level Sensor
Walking			Building Above Removed for Clarity
Uncomfortable			Main Entrance Location
Dangerous			



**Pedestrian Wind Conditions - Mean Speed**  
Build  
Annual

West End Library - Boston, MA



Drawn by: GRE	Figure: 1B
Approx. Scale: 1"=80'	
Date Revised: Dec. 6, 2024	

Project #2409479





**Pedestrian Wind Conditions - Effective Gust Speed**  
No Build  
Annual

West End Library - Boston, MA

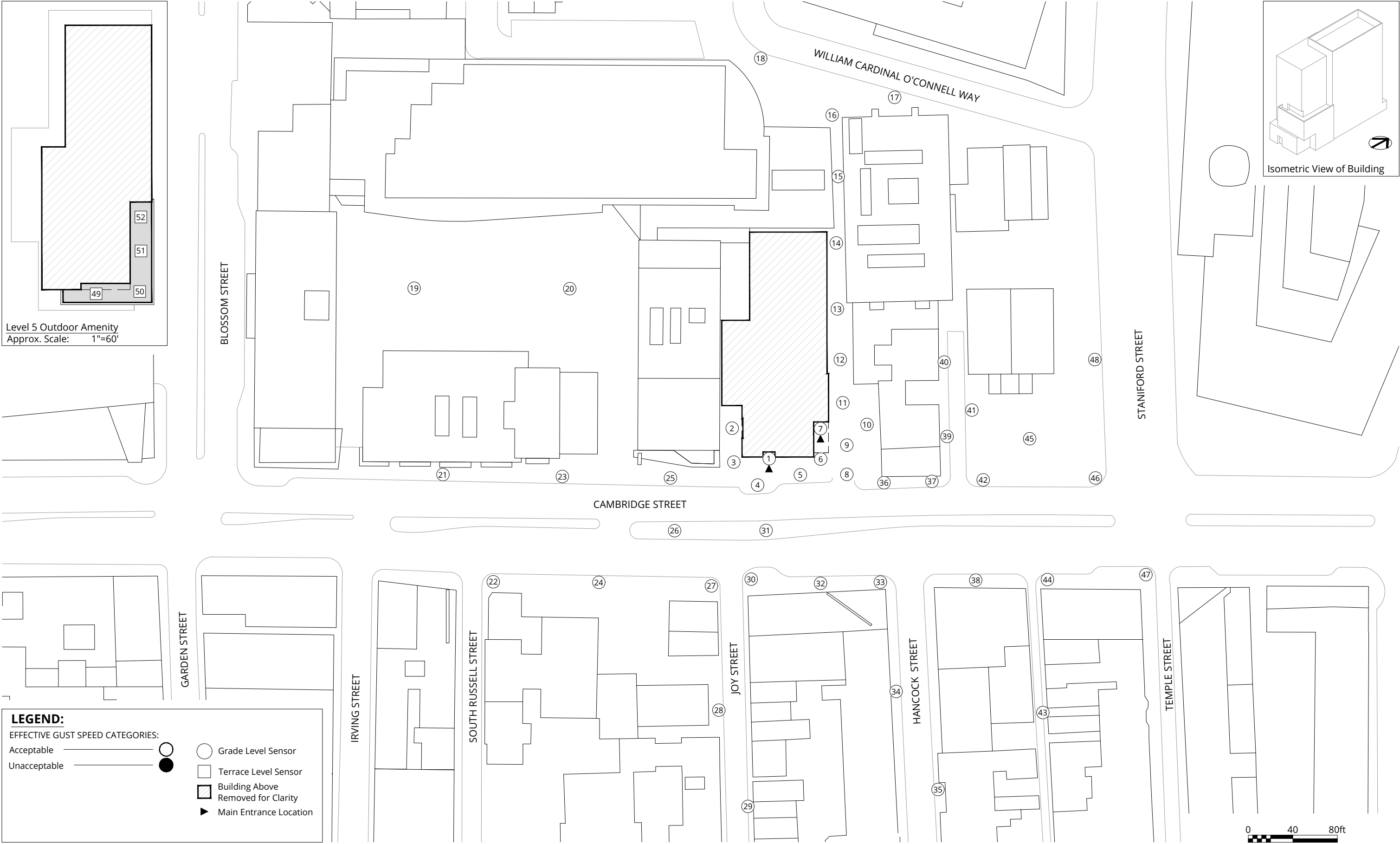


Drawn by: GRE	Figure: 2A
Approx. Scale: 1"=80'	
Date Revised: Dec. 6, 2024	

Project #2409479







**Pedestrian Wind Conditions - Effective Gust Speed**  
Build  
Annual

West End Library - Boston, MA



Drawn by: GRE	Figure: 2B
Approx. Scale: 1"=80'	
Date Revised: Dec. 6, 2024	

Project #2409479



A decorative graphic on the left side of the page. It features a solid blue right-angled triangle in the upper-left corner. A large, light-grey circle overlaps the triangle and extends across the middle and lower portions of the page. The word 'TABLES' is centered within the grey circle in a blue, sans-serif font.

# TABLES

**Table 1: Mean Speed and Effective Gust Categories - Annual**

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
1	No Build Build	Annual	12		Sitting	17		Acceptable
		Annual	8	-33%	Sitting	12	-29%	Acceptable
2	No Build Build	-	-		-	-		-
		Annual	8		Sitting	14		Acceptable
3	No Build Build	Annual	12		Sitting	18		Acceptable
		Annual	10	-17%	Sitting	16	-11%	Acceptable
4	No Build Build	Annual	14		Standing	20		Acceptable
		Annual	14		Standing	21		Acceptable
5	No Build Build	Annual	12		Sitting	18		Acceptable
		Annual	16	33%	Walking	22	22%	Acceptable
6	No Build Build	Annual	11		Sitting	17		Acceptable
		Annual	20	82%	Uncomfortable	26	53%	Acceptable
7	No Build Build	Annual	10		Sitting	15		Acceptable
		Annual	7	-30%	Sitting	12	-20%	Acceptable
8	No Build Build	Annual	9		Sitting	14		Acceptable
		Annual	15	67%	Standing	21	50%	Acceptable
9	No Build Build	Annual	7		Sitting	12		Acceptable
		Annual	17	143%	Walking	23	92%	Acceptable
10	No Build Build	Annual	9		Sitting	15		Acceptable
		Annual	17	89%	Walking	23	53%	Acceptable
11	No Build Build	Annual	12		Sitting	17		Acceptable
		Annual	15	25%	Standing	22	29%	Acceptable
12	No Build Build	Annual	11		Sitting	17		Acceptable
		Annual	9	-18%	Sitting	14	-18%	Acceptable
13	No Build Build	Annual	10		Sitting	15		Acceptable
		Annual	8	-20%	Sitting	12	-20%	Acceptable
14	No Build Build	Annual	8		Sitting	13		Acceptable
		Annual	11	38%	Sitting	15	15%	Acceptable
15	No Build Build	Annual	12		Sitting	18		Acceptable
		Annual	13		Standing	19		Acceptable
16	No Build Build	Annual	12		Sitting	18		Acceptable
		Annual	13		Standing	19		Acceptable

**Table 1: Mean Speed and Effective Gust Categories - Annual**

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
17	No Build Build	Annual	12		Sitting	19		Acceptable
		Annual	12		Sitting	19		Acceptable
18	No Build Build	Annual	16		Walking	24		Acceptable
		Annual	16		Walking	24		Acceptable
19	No Build Build	Annual	12		Sitting	18		Acceptable
		Annual	12		Sitting	18		Acceptable
20	No Build Build	Annual	17		Walking	25		Acceptable
		Annual	16		Walking	24		Acceptable
21	No Build Build	Annual	15		Standing	21		Acceptable
		Annual	14		Standing	21		Acceptable
22	No Build Build	Annual	8		Sitting	13		Acceptable
		Annual	8		Sitting	13		Acceptable
23	No Build Build	Annual	12		Sitting	18		Acceptable
		Annual	12		Sitting	18		Acceptable
24	No Build Build	Annual	12		Sitting	18		Acceptable
		Annual	11		Sitting	18		Acceptable
25	No Build Build	Annual	11		Sitting	17		Acceptable
		Annual	9	-18%	Sitting	15	-12%	Acceptable
26	No Build Build	Annual	15		Standing	22		Acceptable
		Annual	13	-13%	Standing	20		Acceptable
27	No Build Build	Annual	10		Sitting	15		Acceptable
		Annual	12	20%	Sitting	18	20%	Acceptable
28	No Build Build	Annual	7		Sitting	11		Acceptable
		Annual	6	-14%	Sitting	10		Acceptable
29	No Build Build	Annual	8		Sitting	13		Acceptable
		Annual	8		Sitting	13		Acceptable
30	No Build Build	Annual	11		Sitting	16		Acceptable
		Annual	13	18%	Standing	18	13%	Acceptable
31	No Build Build	Annual	13		Standing	19		Acceptable
		Annual	16	23%	Walking	23	21%	Acceptable
32	No Build Build	Annual	9		Sitting	15		Acceptable
		Annual	11	22%	Sitting	16		Acceptable

**Table 1: Mean Speed and Effective Gust Categories - Annual**

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
33	No Build Build	Annual	9		Sitting	15		Acceptable
		Annual	10	11%	Sitting	16		Acceptable
34	No Build Build	Annual	7		Sitting	11		Acceptable
		Annual	7		Sitting	11		Acceptable
35	No Build Build	Annual	7		Sitting	10		Acceptable
		Annual	7		Sitting	11		Acceptable
36	No Build Build	Annual	12		Sitting	19		Acceptable
		Annual	15	25%	Standing	22	16%	Acceptable
37	No Build Build	Annual	9		Sitting	13		Acceptable
		Annual	12	33%	Sitting	16	23%	Acceptable
38	No Build Build	Annual	8		Sitting	14		Acceptable
		Annual	9	13%	Sitting	14		Acceptable
39	No Build Build	Annual	7		Sitting	12		Acceptable
		Annual	9	29%	Sitting	14	17%	Acceptable
40	No Build Build	Annual	7		Sitting	12		Acceptable
		Annual	9	29%	Sitting	14	17%	Acceptable
41	No Build Build	Annual	11		Sitting	17		Acceptable
		Annual	13	18%	Standing	19	12%	Acceptable
42	No Build Build	Annual	10		Sitting	15		Acceptable
		Annual	13	30%	Standing	18	20%	Acceptable
43	No Build Build	Annual	8		Sitting	13		Acceptable
		Annual	9	13%	Sitting	14		Acceptable
44	No Build Build	Annual	7		Sitting	12		Acceptable
		Annual	7		Sitting	12		Acceptable
45	No Build Build	Annual	8		Sitting	14		Acceptable
		Annual	9	13%	Sitting	15		Acceptable
46	No Build Build	Annual	10		Sitting	16		Acceptable
		Annual	10		Sitting	17		Acceptable
47	No Build Build	Annual	9		Sitting	15		Acceptable
		Annual	9		Sitting	15		Acceptable
48	No Build Build	Annual	10		Sitting	16		Acceptable
		Annual	11		Sitting	17		Acceptable

**Table 1: Mean Speed and Effective Gust Categories - Annual**

Location	Configuration	Season	Mean Wind Speed			Effective Gust Wind Speed		
			Speed (mph)	% Change	Rating	Speed (mph)	% Change	Rating
<b>49</b>	No Build Build	- Annual	- 12	-	Sitting	- 19	-	Acceptable
<b>50</b>	No Build Build	- Annual	- 16	-	Walking	- 21	-	Acceptable
<b>51</b>	No Build Build	- Annual	- 8	-	Sitting	- 13	-	Acceptable
<b>52</b>	No Build Build	- Annual	- 7	-	Sitting	- 12	-	Acceptable

Configurations		Mean Wind Criteria Speed (mph)		Effective Gust Criteria (mph)
<b>No Build</b>	Existing site and surroundings	≤ 12	Comfortable for Sitting	≤ 31 Acceptable
		13 - 15	Comfortable for Standing	> 31 Unacceptable
<b>Build</b>	Existing surroundings with proposed development	16 - 19	Comfortable for Walking	
		20 - 27	Uncomfortable for Walking	
		> 27	Dangerous Conditions	

**Notes**

- 1) Wind Speeds are for a 1% probability of exceedance
- 2) % Change is based on comparison with No Build Configuration
- 3) % changes less than 10% are excluded

**Table 2: Mean Speed and Effective Gust Categories - Seasonal**

Location	Configuration	Mean Wind Speed (mph)				Effective Gust Wind Speed (mph)			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
<b>1</b>	No Build Build	12	11	12	13	18	16	17	18
		9	7	8	8	13	11	12	13
<b>2</b>	No Build Build	-	-	-	-	-	-	-	-
		9	8	8	8	15	13	14	14
<b>3</b>	No Build Build	12	11	12	13	18	16	17	19
		10	8	9	11	16	13	15	17
<b>4</b>	No Build Build	14	13	14	14	20	18	20	21
		15	13	14	16	21	18	20	23
<b>5</b>	No Build Build	13	11	12	13	19	17	18	19
		16	14	15	16	23	19	21	23
<b>6</b>	No Build Build	12	10	11	12	17	16	17	17
		21	18	20	21	27	23	26	27
<b>7</b>	No Build Build	10	9	10	10	16	14	15	16
		8	6	7	7	13	10	12	12
<b>8</b>	No Build Build	10	8	9	10	15	13	14	15
		16	13	15	16	22	18	21	22
<b>9</b>	No Build Build	8	7	7	8	13	11	12	13
		18	15	17	18	24	21	23	24
<b>10</b>	No Build Build	10	9	9	10	16	14	15	16
		18	16	17	18	24	21	23	25
<b>11</b>	No Build Build	12	11	12	13	17	16	17	18
		15	13	14	15	23	19	21	23
<b>12</b>	No Build Build	12	10	11	12	18	16	17	18
		9	7	9	9	14	11	14	14
<b>13</b>	No Build Build	10	9	10	10	15	14	15	16
		8	7	8	9	13	11	12	13
<b>14</b>	No Build Build	9	7	8	9	13	11	13	14
		11	10	10	11	15	14	15	16
<b>15</b>	No Build Build	12	9	11	13	18	14	17	19
		13	11	13	14	20	16	19	20
<b>16</b>	No Build Build	12	10	12	13	19	14	18	20
		14	10	13	14	20	15	19	21



**Table 2: Mean Speed and Effective Gust Categories - Seasonal**

Location	Configuration	Mean Wind Speed (mph)				Effective Gust Wind Speed (mph)			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
17	No Build	12	10	11	13	19	15	18	20
	Build	12	10	12	13	19	15	18	21
18	No Build	16	12	15	17	24	18	22	26
	Build	17	12	15	18	25	18	23	26
19	No Build	13	11	12	13	19	16	18	20
	Build	12	11	12	12	19	17	18	19
20	No Build	17	16	16	18	25	23	24	26
	Build	16	15	16	17	24	22	24	25
21	No Build	15	14	14	15	21	20	21	22
	Build	14	13	14	15	21	19	20	22
22	No Build	9	7	8	8	14	12	13	14
	Build	8	7	8	8	13	11	13	13
23	No Build	12	12	12	13	19	17	18	20
	Build	12	11	12	13	18	17	18	19
24	No Build	13	10	12	13	19	15	18	20
	Build	12	10	11	12	18	15	18	19
25	No Build	11	10	11	12	18	15	17	18
	Build	9	8	9	10	15	13	14	15
26	No Build	16	13	15	16	23	19	22	23
	Build	14	12	13	14	21	18	20	21
27	No Build	11	9	10	10	16	14	15	16
	Build	13	10	12	13	19	15	18	18
28	No Build	7	5	6	7	11	9	11	12
	Build	6	5	6	7	11	8	10	11
29	No Build	8	6	7	8	13	11	12	13
	Build	8	6	7	8	13	10	12	14
30	No Build	11	9	11	12	17	14	16	17
	Build	14	10	13	13	20	15	18	19
31	No Build	14	12	13	14	20	17	19	20
	Build	17	13	16	17	24	19	23	24
32	No Build	10	8	9	10	16	13	15	16
	Build	12	10	11	12	17	14	16	17

**Table 2: Mean Speed and Effective Gust Categories - Seasonal**

Location	Configuration	Mean Wind Speed (mph)				Effective Gust Wind Speed (mph)			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
33	No Build Build	10	7	9	10	16	12	15	16
		11	9	10	11	17	14	16	17
34	No Build Build	7	7	7	8	12	10	11	12
		7	7	7	8	12	10	11	12
35	No Build Build	7	6	7	7	11	9	10	11
		7	6	7	7	11	9	10	11
36	No Build Build	13	11	12	13	20	18	19	20
		15	14	15	15	23	21	22	23
37	No Build Build	9	8	9	9	14	12	13	14
		12	11	12	13	17	15	16	18
38	No Build Build	9	7	8	9	15	11	13	15
		9	7	8	9	15	11	14	15
39	No Build Build	7	7	7	8	12	11	12	13
		10	9	9	10	15	13	14	15
40	No Build Build	8	7	7	8	13	11	12	13
		9	8	9	10	15	13	14	15
41	No Build Build	11	10	11	11	17	15	17	18
		14	12	13	14	20	18	19	20
42	No Build Build	11	10	10	11	16	14	15	16
		13	12	13	14	18	17	18	19
43	No Build Build	9	7	8	9	14	11	13	14
		9	7	9	9	14	11	13	14
44	No Build Build	8	6	7	8	13	10	12	13
		8	6	7	8	13	10	12	13
45	No Build Build	8	7	8	9	14	12	13	14
		9	8	9	10	15	13	15	16
46	No Build Build	10	8	9	10	17	14	15	17
		11	9	10	11	17	15	16	18
47	No Build Build	9	7	9	9	16	12	14	16
		9	7	9	9	16	12	14	15
48	No Build Build	11	9	10	11	17	13	16	18
		12	10	11	12	18	15	17	19

**Table 2: Mean Speed and Effective Gust Categories - Seasonal**

Location	Configuration	Mean Wind Speed (mph)				Effective Gust Wind Speed (mph)			
		Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
<b>49</b>	No Build	-	-	-	-	-	-	-	-
	Build	13	11	12	13	20	17	19	20
<b>50</b>	No Build	-	-	-	-	-	-	-	-
	Build	17	14	16	17	22	19	21	22
<b>51</b>	No Build	-	-	-	-	-	-	-	-
	Build	8	6	8	8	14	10	13	14
<b>52</b>	No Build	-	-	-	-	-	-	-	-
	Build	8	6	7	8	13	10	12	12

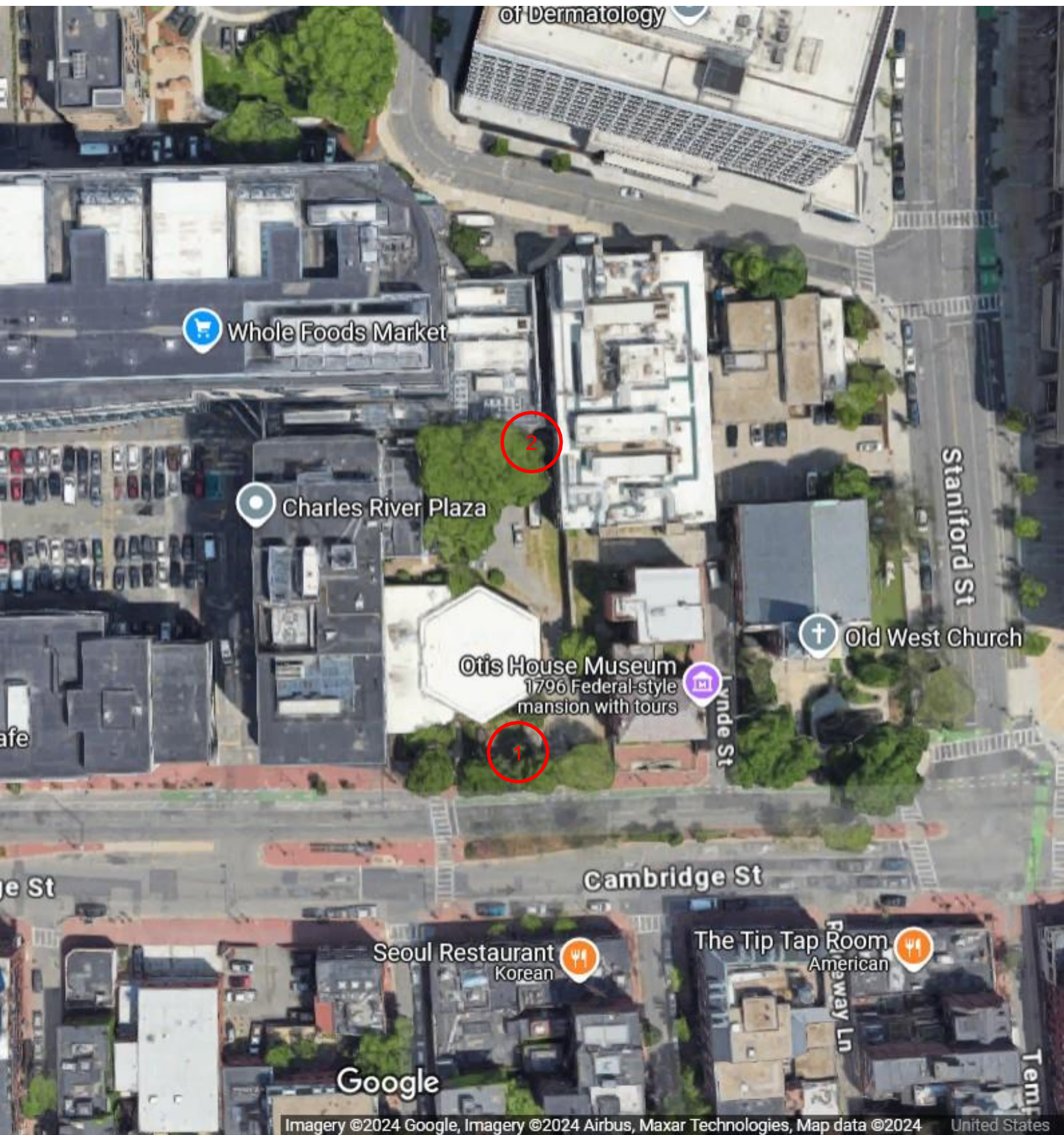
Seasons	Months	Mean Wind Criteria Speed (mph)		Effective Gust Criteria (mph)
Spring	March - May	≤ 12	Comfortable for Sitting	≤ 31 Acceptable
Summer	June - August	13 - 15	Comfortable for Standing	> 31 Unacceptable
Fall	September - November	16 - 19	Comfortable for Walking	
Winter	December - February	20 - 27	Uncomfortable for Walking	
Annual	January - December	> 27	Dangerous Conditions	
Configurations				
No Build	Existing site and surroundings			
Build	Existing surroundings with proposed development			
Notes				
1) Wind Speeds are for a 1% probability of exceedance				

## **Appendix G – Transportation Back Up Data**

Available upon request.

## **Appendix H – Noise Measurement Locations Site Plan**

Acentech Environmental Noise Monitor Locations Sept. 25 - Oct. 3, 2024



## **Appendix I – Arborist Report**





**West End Library  
Boston, MA**

---

## **Tree Preservation Report**

### **PREPARED FOR:**

Preservation of Affordable Housing Inc.  
2 Oliver Street, Suite 500  
Boston, MA 02109

### **PREPARED BY:**

Kat Cummings  
New England Division Consulting Arborist  
ASCA Registered Consulting Arborist #781  
ASCA Tree and Plant Appraisal Qualified  
ISA Board Certified Master Arborist #NE-7396BM  
Massachusetts Certified Arborist #102013  
ISA Tree Risk Assessment Qualified

### **PROVIDED BY:**

Andrew Balon  
Arborist Representative  
ISA Certified Arborist  
ISA Tree Risk Assessment Qualified  
50 Bear Hill Rd,  
Waltham, MA 02451  
(781) 622 5980



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## Summary

Bartlett Tree Experts was retained to evaluate trees at the West End Library, located at 151 Cambridge Street in Boston, MA. Bartlett Tree Experts was also asked to prepare a Tree Preservation Report for the trees.

Nine trees were evaluated on site for health and structural condition on August 22, 2024. Existing site maps and design plans were supplied by G2 Collaborative Landscape Architecture. This evaluation was based on site observations and a review of all plans supplied by G2 Collaborative Landscape Architecture. Copies of all plan documents reviewed can be found in Appendix I.

Most of the trees were observed to be in good condition at the time of the site visit. Trees 4 and 6 were observed to be in fair condition, and Tree 5 was found to be in poor condition. All trees on the property were not recommended for retention based on current construction plans. If retention of these trees is desired, construction plans must be changed to account for appropriate tree preservation measures. Trees where roots may sustain significant damage by construction activities are not recommended for retention. Additionally, mature trees are more difficult to retain during construction activities than younger trees.

## Introduction

Preservation of Affordable Housing Inc. and G2 Collaborative Landscape Architecture will be re-developing the West End Library building located at 151 Cambridge Street in Boston, MA. Bartlett Tree Experts was asked to evaluate the trees and prepare a report that summarizes site observations, reviews provided site maps and documents, and evaluates the potential for tree preservation and retention.

## Assignment

This report communicates the anticipated impacts to trees from construction to the client. The report is designed to provide the design team/construction contractors with the tree-related details they will need to prepare a Tree Preservation Plan, including:

- observations of the health and structural condition of the trees,
- determination of potential for being retained through construction, and
- evaluation of the potential impacts to trees.

## Limits of the Assignment

Trees were assessed from the ground for visual conditions. This tree inventory was not a tree risk assessment. As such, no trees were assessed for risk in accordance with industry standards, nor are there any tree risk ratings or risk mitigation recommendations provided within this report.

Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible; however, the consultant can neither guarantee nor be responsible for the accuracy of information provided by others.

Illustrations, diagrams, graphs, and photographs in this report, being intended as visual aids, are not necessarily to scale and should not be construed as engineering or architectural reports or surveys.

Information contained in this report covers only those items that were examined and reflects the condition of those items at the time of inspection. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the plans or property in question may not arise in the future.

## Methods

Trees were assessed on August 22, 2024. The assessment was of nine trees throughout the property. Proposed construction activities include demolishing the existing building and installing a new building with new utilities and infrastructure. The provided maps and plans for the project are provided in Appendix I.

1. Identifying the species of tree;
2. Measuring the trunk diameter at a point 54 inches above grade;
3. Evaluating the health and structural condition;
4. Evaluating if planned construction activities eliminate potential for tree retention.

<b>Good</b>	A healthy tree that may have a slight decline in vigor, small amount of twig dieback, minor structural defects that could be corrected;
<b>Fair</b>	Tree with moderate vigor, moderate twig and small branch dieback, thinning of crown, poor leaf color, moderate structural defects that might be mitigated with regular care;
<b>Poor</b>	Tree in decline, epicormic growth, extensive dieback of medium to large branches, significant structural defects that cannot be abated;

## Observations

The trees were located at the West End Library in Boston, Massachusetts. This area is an urban environment surrounded by buildings and hardscape. Trees 1 and 5 are close to the existing library building on the south. Public brick sidewalks are located at the southern side of the property and are surrounding Trees 2, 3, and 4. Trees 6, 7, 8, and 9 are located to the north of the existing library building. Tree 6 was located close to the building in a mulched planting bed. Trees 7, 8, and 9 were in a lawn area at the northernmost part of the property adjacent to neighboring buildings.

These findings may be summarized in the following table.

**TABLE 1: TREE CONDITION AND ABUNDANCE**

Common Name	Scientific Name	Dead	Poor	Fair	Good	Total
Witchhazel	<i>Hamamelis sp.</i>	-	-	1	-	1
Crabapple	<i>Malus sp.</i>	-	-	-	1	1
Cherry-Flowering	<i>Prunus serrulata</i>	-	1	-	-	1
Pagodatree-Japanese	<i>Styphnolobium japonicum</i>	-	-	-	3	3
Linden-Littleleaf	<i>Tilia cordata</i>	-	-	1	2	3
<b>Total</b>		-	1	2	6	9

Additional images of select trees and the site can be found in Appendix III.

## Tree Impacts

Tree Protection Zones (TPZ) and Critical Root Zones (CRZ) were calculated for all trees existing on the site for the purposes of illustrating how much space would be required for trees growing in an open area. The Tree Protection Zone (TPZ) and Critical Root Zone (CRZ) values can be found on the Tree Inventory Table (Appendix II).

The Tree Protection Zone is an area surrounding the tree in which most of the tree's water and nutrient uptake occurs. The TPZ is an area in which construction activities are prohibited or restricted in order to safeguard tree health, especially before and during construction. This value was based on condition rating, age class, and species tolerance of construction activity. Generally, trees that are young and in good condition are more able to tolerate damage associated with construction activities than those that are mature, stressed, or in low vigor. Trees that are in poor condition prior to construction activities have the potential to continue to decline regardless of any construction occurring.

The TPZ also includes the Critical Root Zone, which is a smaller circular area located directly next to the trunk. The Critical Root Zone has roots that are the most important to tree health and structural stability. The CRZ was calculated based on tree Diameter at Breast Height (DBH). On this site, trees close to paved surfaces and proximity to existing infrastructure may impact the shapes of root zones. Compacted conditions associated with hardscape may be a more difficult place for roots to grow.

Site plans provided by G2 Collaborative Landscape Architecture were reviewed to view anticipated impacts to trees. Based on these documents, it is interpreted that all trees on the site are not recommended for retention during construction. Trees 1, 6, 7, 8, and 9 are all anticipated to be within the confines of the proposed building. These trees cannot be retained unless significant changes are done to the location and shape of the building.

Additionally, Trees 2, 3, 4, and 5 are anticipated to be significantly impacted by construction activities. Approximately 60% of the root zones of Trees 2, 3, and 4 were observed to be covered in hardscape. Hardscape and compacted conditions associated with hardscape are difficult environments for roots to grow and develop. It is anticipated that the root zones of all three of these trees are more heavily on the side of the trees towards the existing building. Lifting of the curbing in the planting beds towards the lawn or mulched areas by the existing building suggest the presence of significant roots. The installation of the building and utilities within 10 feet or less of the three linden trees is encroachment within the TPZ and may even be within the CRZ. These activities have the potential to severely impact tree health and longevity. Root pruning and other activities associated with construction closer than 10 feet may also have the potential to impact tree stability.

Tree 5 was observed to be in poor condition at the time of the site visit. It was observed to have significant defects that may make it difficult for the tree to tolerate construction activities such as damaged roots and low vigor. This tree was also determined to be close to the proposed building and may also sustain significant injury during construction activities. Proposed construction is likely within the TPZ of the tree. It is recommended that this tree also be removed and replaced with a healthy, young tree following construction.

## Suitability for Preservation

Before evaluating the impacts that will occur during development, it is important to consider the quality of the tree resource itself, and the potential for individual trees to function well over an extended length of time. Trees that are preserved on development sites must be carefully selected to make sure that they may survive development impacts, adapt to a new environment and perform well in the landscape.

Our goal is to identify trees that have the potential for long-term health, structural stability, and longevity. For trees growing in open fields, away from areas where people and property are present, structural defects and/or poor health presents a low risk of damage or injury if they fail. However, we must be concerned about safety in use areas. Therefore, where development encroaches into existing plantings, we must consider their structural stability as well as their potential to grow and thrive in a new environment. Where development will not occur, the normal life cycles of decline, structural failure and death should be allowed to continue. Evaluation of suitability for preservation considers several factors:

- **Tree health**

Healthy, vigorous trees are better able to tolerate impacts such as root injury, demolition of existing structures, changes in soil grade and moisture, and soil compaction than are non-vigorous trees.

- **Structural integrity**

Trees with significant amounts of wood decay and other structural defects that cannot be corrected are likely to fail. Such trees should not be preserved in areas where damage to people or property is likely.

- **Species response**

There is a wide variation in the response of individual species to construction impacts and changes in the environment.

- **Tree age and longevity**

Old trees, while having significant emotional and aesthetic appeal, have limited physiological capacity to adjust to an altered environment. Young trees are better able to generate new tissue and respond to change.

- **Species invasiveness**

Species that spread across a site and displace desired vegetation are not always appropriate for retention. This is particularly true when indigenous species are displaced.

Each tree was rated for suitability for preservation based upon its age, health, structural condition, and ability to safely coexist within a development environment. We consider trees with high suitability for preservation to be the best candidates for preservation. We do not recommend retention of trees with low suitability for preservation in areas where people or property will be present. Retention of trees with moderate suitability for preservation depends upon the intensity of proposed site changes.

**High** These are trees with good health and structural stability that have the potential for longevity at the site. Also, a review of the site plans suggest that tree retention is possible with the current plans.

**Moderate** Trees in this category have fair health and/or structural defects that may be abated with treatment. These trees require more intense management and monitoring and may have shorter lifespans than those in the “high” category. Site plans may also need to be adjusted slightly in order to improve expected tree health and sustainability.

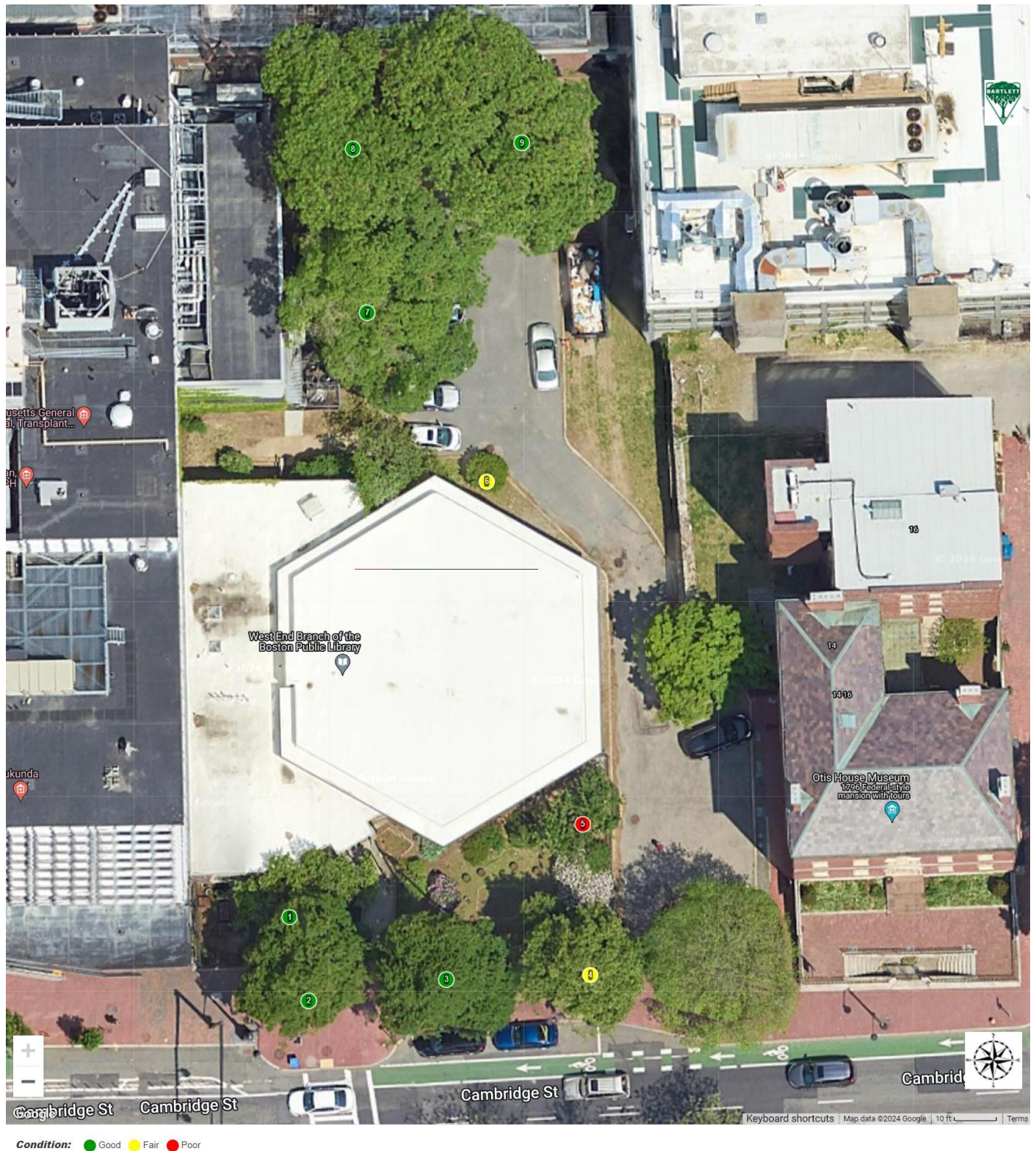
**Low** Trees in this category are in poor health or have significant defects in structure that cannot be abated with treatment. These trees can be expected to decline regardless of management. The species or individual tree may possess either characteristics that are undesirable in landscape settings or be unsuited for use areas.

The suitability for preservation values assigned to each tree can be found in the Tree Inventory Table in Appendix II. It is important to emphasize that suitability for preservation values do not take proposed construction activities into account. Tree suitability for preservation ratings are independent of whether a tree should be retained on the site or not. Tree retention recommendations are based on many other factors.

Tree preservation is intended to not only foster tree survival during development, but also to promote maintenance of tree health and beauty into the future. Retained trees that are injured or damaged during construction or are insufficiently maintained afterward become a liability rather than an asset. How individual trees respond to disturbances will depend on the extent of excavation and grading, the care with which demolition is undertaken, and the construction methods employed. Coordinating any construction activity inside the Tree Protection Zone (TPZ) can minimize these impacts.



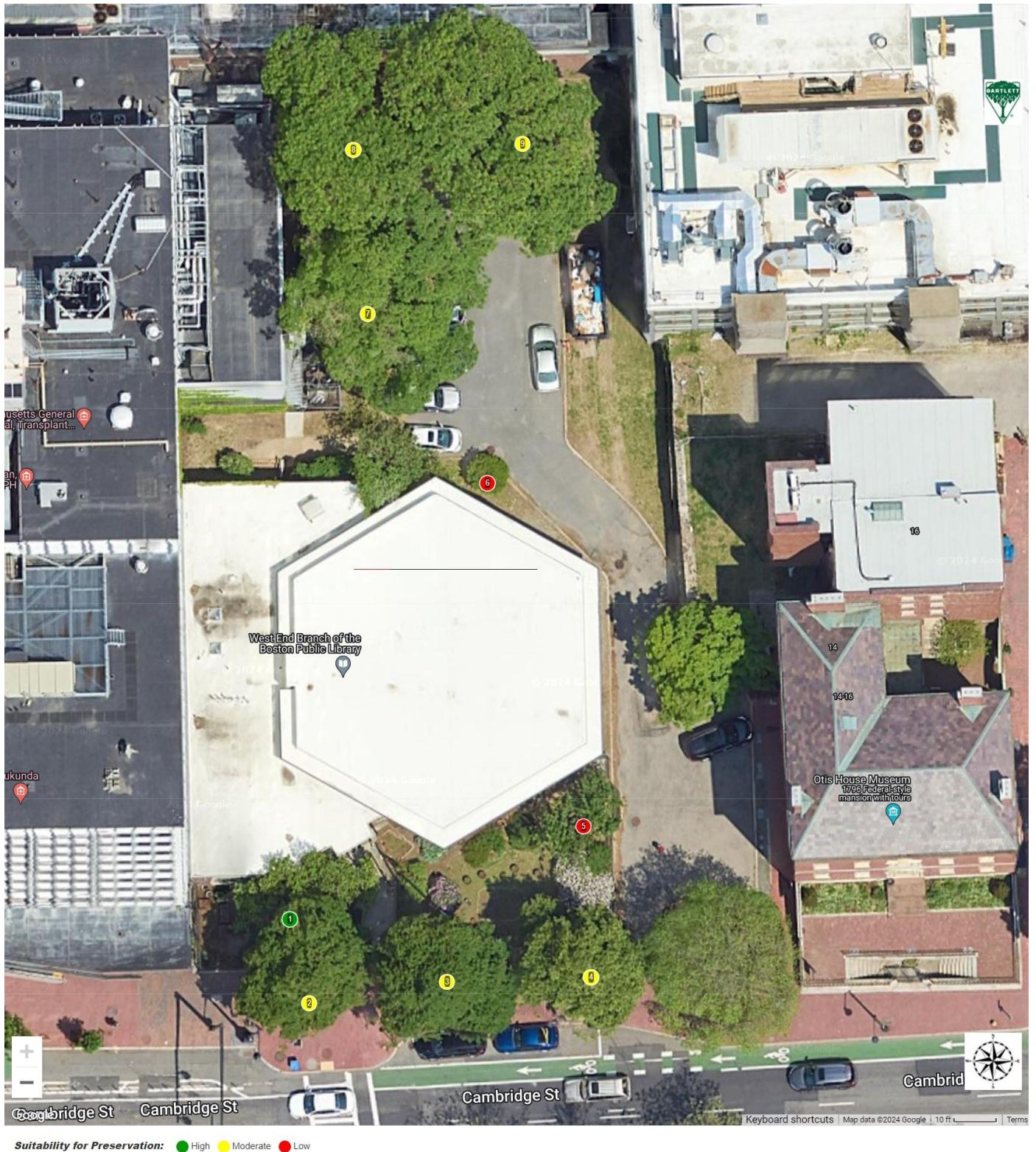
## Appendix I –Maps and Provided Documents



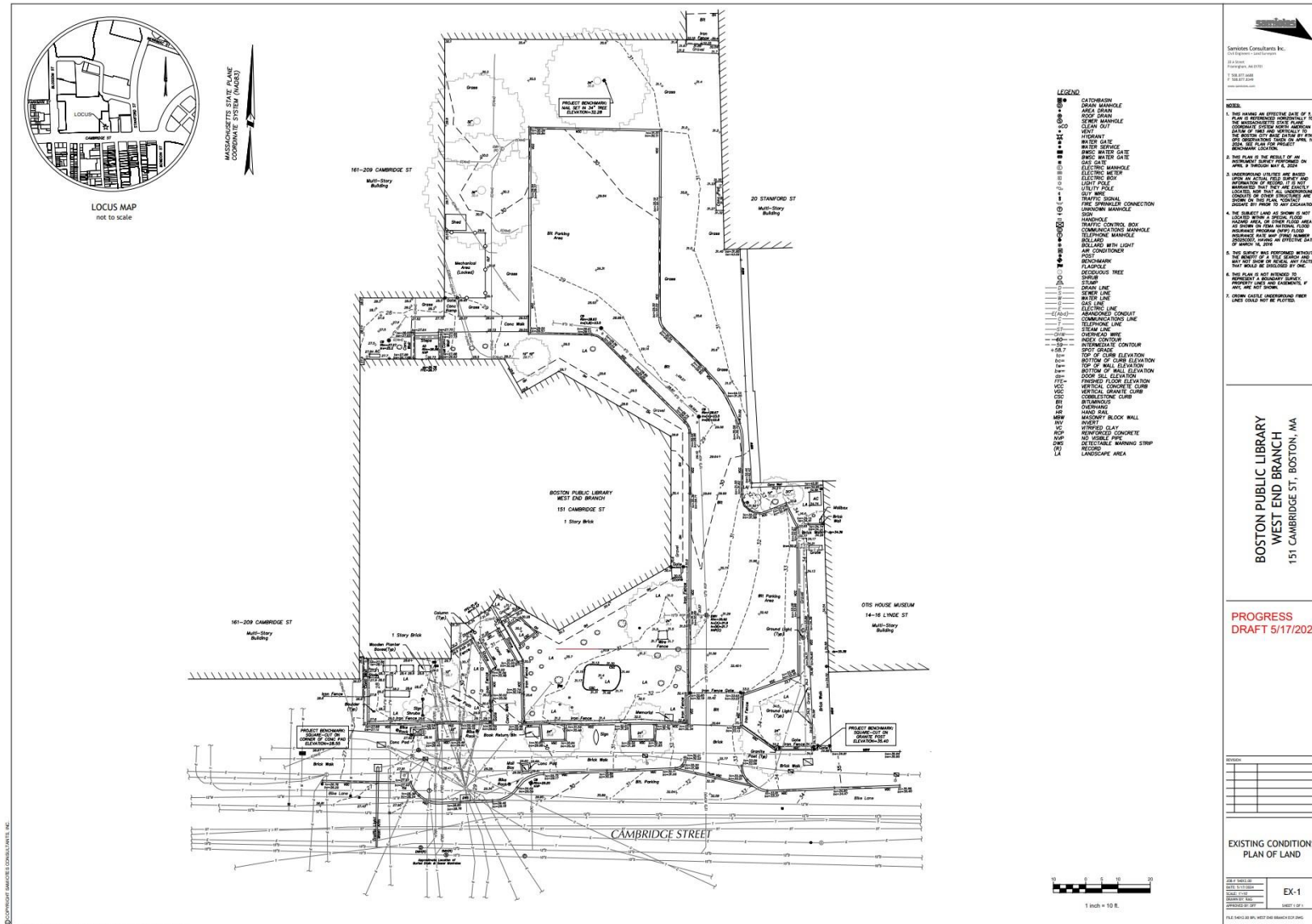
**Map 1.** Condition map generated using the Arborscope program. This map shows all trees included in this report and their assigned condition classes recorded during the site visit on August 22, 2024.

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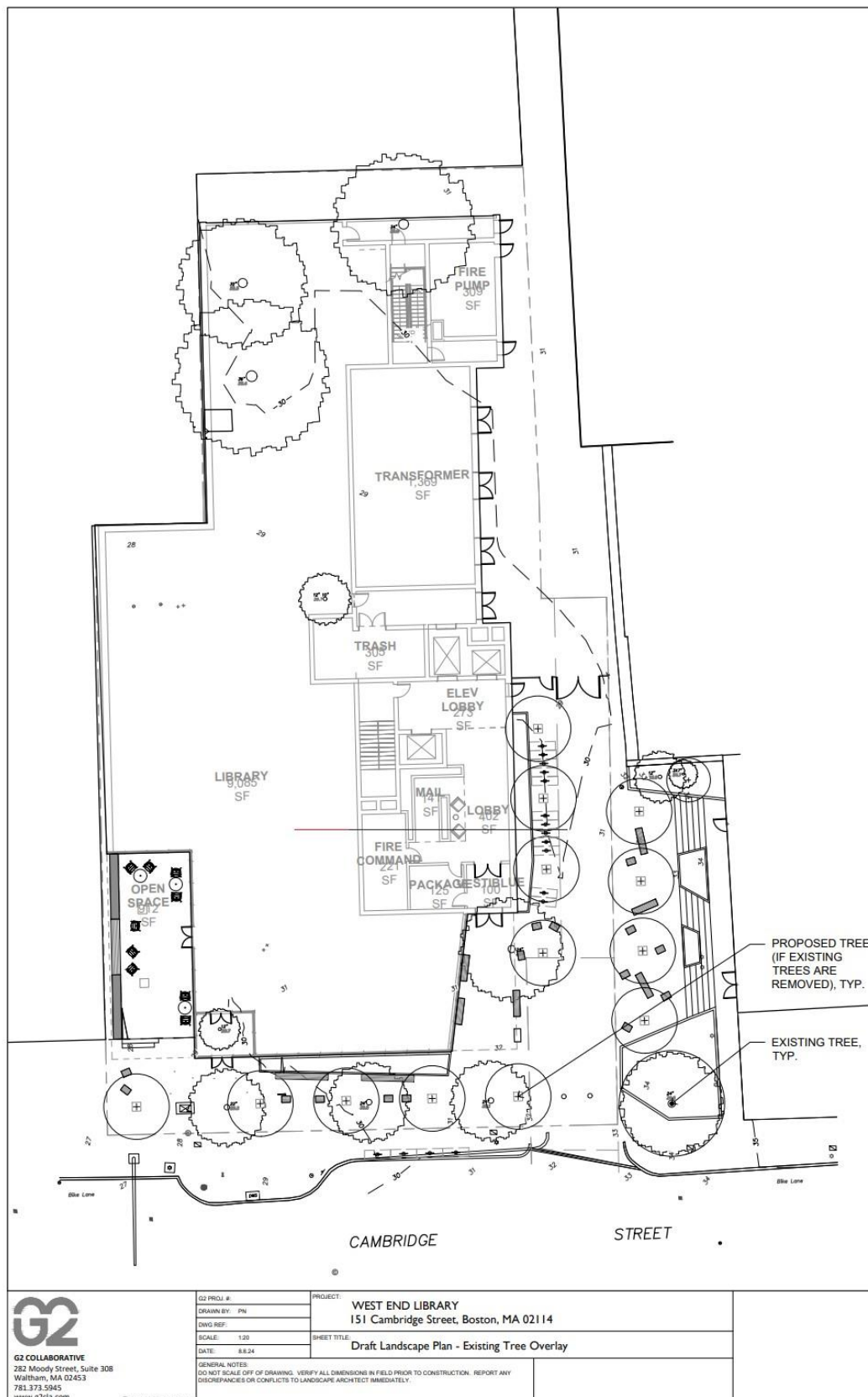


**Map 2.** Suitability for preservation map generated using the Arborscope program. This map shows all trees included in this report and their assigned suitability for preservation rating recorded during the site visit on August 22, 2024.



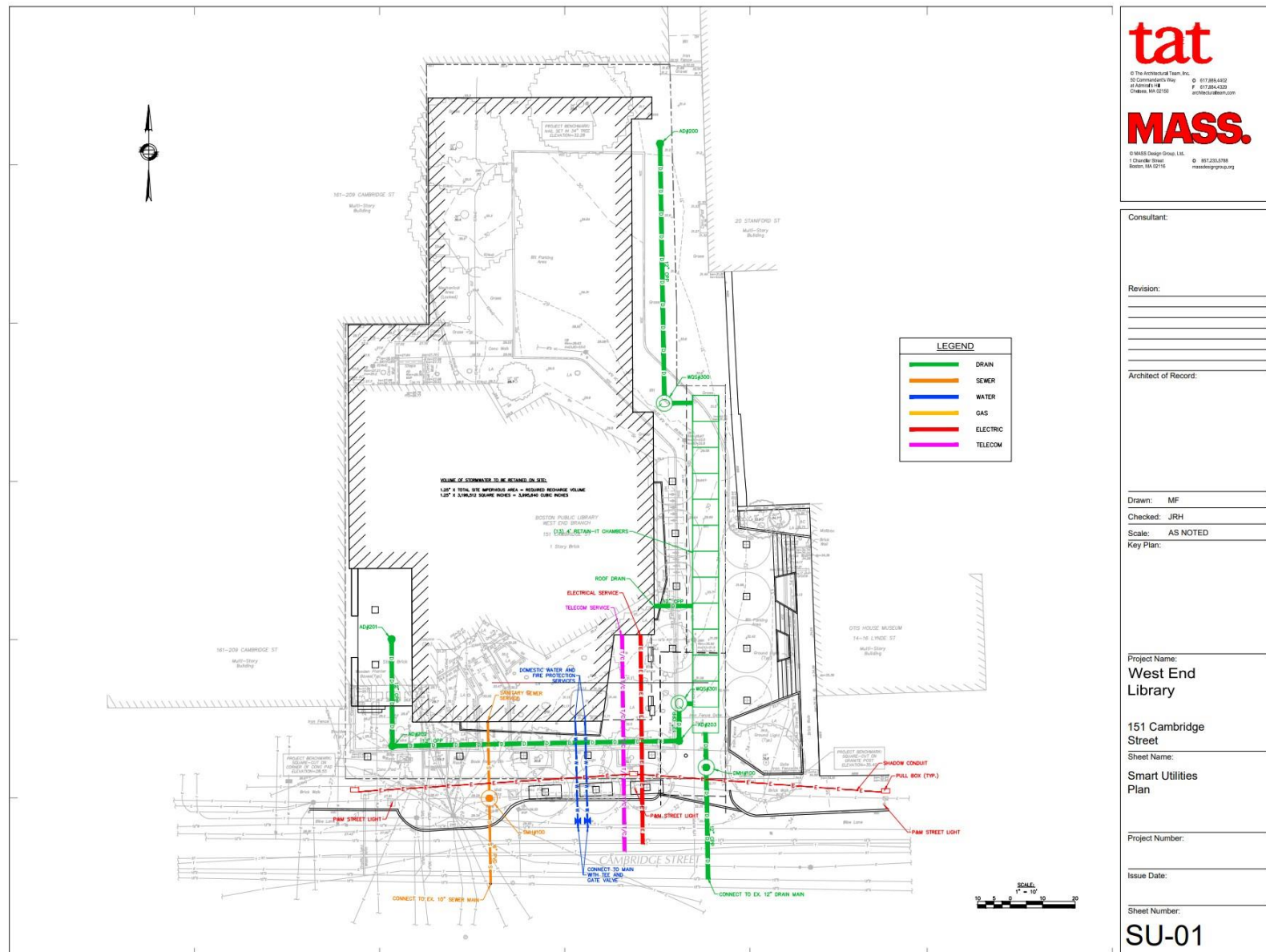
**Map 3.** Existing site map provided by G2 Collaborative Landscape Architecture. This map shows the existing trees slightly muted.





**Map 4.** Landscape plan map provided by G2 Collaborative Landscape Architecture. This map the landscape plan with the existing tree locations overlaid. Five out of the nine trees existing on the property are intended to be within the planned building.

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**Map 5.** Smart Utilities plan map provided by G2 Collaborative Landscape Architecture. This map shows anticipated utility installations. Drain installations are expected to be installed very close to Trees

## Appendix II – Tree Inventory Table

Tree ID	Common Name	Condition Class	DBH (inches)*	Age Class	Suitability For Preservation	TPZ (feet)	CRZ (feet)	Retention
1	Crabapple	Good	9	Young	High	8.91	4.50	No
2	Linden-Littleleaf	Good	19	Mature	Moderate	20.90	9.50	No
3	Linden-Littleleaf	Good	21	Mature	Moderate	23.10	10.50	No
4	Linden-Littleleaf	Fair	21	Mature	Moderate	24.26	10.50	No
5	Cherry-Flowering	Poor	15	Semi-mature	Low	18.15	7.50	No
6	Witchhazel	Fair	10.5	Semi-mature	Low	12.13	5.25	No
7	Pagodatree-Japanese	Good	29	Mature	Moderate	28.71	14.50	No
8	Pagodatree-Japanese	Good	25	Mature	Moderate	24.75	12.50	No
9	Pagodatree-Japanese	Good	30	Mature	Moderate	29.70	15.00	No

\* DBH values were adjusted to reflect multiple stems where applicable. In the case of a tree with multiple stems, the DBH of the largest stem was added to the half of any other additional stems observed.



### Appendix III – Selected Tree Images



**Photo 1.** Image of Tree 1 on the West End Library site. This tree appears to be in good condition, however may not be suitable to preserve due to construction plans.





**Photo 2.** Image of Tree 2. This tree is also in good condition. This tree is anticipated to be significantly impacted by construction because of its limited rooting area. Tree 2 is nearly surrounded by hardscape, except for this mulched area to the right of the tree in the photo. The proposed building is anticipated to go in the mulched area.





**Photo 3.** Image of the lower stem of Tree 3. Trees 2, 3, and 4 are all in these planting spaces that are approximately 5 feet by 7 feet. Movement of the curbing on the backside of the tree in the image suggest significant roots are underneath the curbing and pushing it up. The proposed building is anticipated to be in the lawn area beyond the fence in the image.





**Photo 4.** Image of Trees 3 and 4 facing the street from the existing driveway area. Tree 4 was observed to be in fair condition and showing signs of a corrected lean.





**Photo 5.** Image of Tree 5. This tree was in poor condition due to dieback, root damage, and stem damage. It is likely that this tree would not survive long term in the landscape following construction activities.

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**Photo 6.** Image of Trees 6. This witchhazel was observed to be in fair condition. This tree is anticipated to be within the proposed building and is not suitable to preserve on the site.





**Photo 7.** Image of Tree 7. This tree is a large and mature Japanese Pagodatree in good condition. Vines are covering the stem and major branches of the tree.





**Photo 8.** Image of Tree 8. Trees 6-9 are all anticipated to be within the proposed building. Based on these construction plans, these trees are not suitable to preserve on the site.





**Photo 9.** Image of Tree 9 on the West End Library property.

## **Appendix J – Diversity Equity and Inclusion Plan**

## **Diversity, Equity and Inclusion Plan**

### **Introduction**

In August of 2022, the BPDA Board approved a new policy requesting that project proponents include in their Article 80 filings information describing their plans to advance Diversity, Equity, and Inclusion (“DEI”) efforts through all phases of project development, from predevelopment through construction and ongoing operations.

### **Proponent Information**

The Proponent is deeply committed to advancing DEI across all facets of the Project. We strive to surpass the diversity benchmarks set by the City of Boston and standards for economic inclusion and diversity within the built environment.

Since the initial RFP and Proposal stage of the project, clear objectives were established to embed DEI principles into the core of the Project. These objectives serve as guiding principles throughout predevelopment, construction, Project delivery, and operational phases, enabling the team to effectively gauge our progress and impact.

The DEI objectives extend beyond the composition of the Project team and also guide pivotal elements of the Project itself. These objectives include:

- Facilitating meaningful community engagement in planning and land use decisions;
  - Promoting public health and cultivating a clean, safe environment;
  - Strengthening the existing community;
  - Offering a diverse range of housing options;
  - Ensuring accessibility to transportation alternatives;
  - Enhancing access to educational resources; and
  - Safeguarding and enriching the unique characteristics that define the community.
- DEI principles are applied in all decision-making processes to ensure that the Project reflects values of inclusivity, equity, and community empowerment.



## **Project Team**



Rodger Brown, Managing Director  
Preservation of Affordable Housing



Felicia Dawson, VP of Strategic Partnerships  
POAH Communities



Jonathan Evans, Principal  
MASS Design Group, LTD.



Ryan Jennette, Director of Boston Operations  
Consigli Construction



Meena Jacob, VP of Development  
Preservation of Affordable Housing



Patrick Kimble, Founder and Managing Partner  
Caste Capital



Michael Liu, Senior Partner and Design Principal  
The Architectural Team



Omar McIntosh, Executive Vice President  
Smoot Construction

Diverse leadership is imperative in driving the Project's success. The ownership and development team are led by Preservation of Affordable Housing (POAH) and Caste Capital. These firms (collectively, the Proponent of the Project) are committed to maximizing participation by Minority & Women Business Enterprise ("M/WBE") firms and individuals throughout the full lifecycle of the Project by providing meaningful opportunities for underrepresented entrepreneurs.

POAH is a non-profit, mission-driven organization that not only develops and manages housing but works to strengthen communities by enabling resident access to greater opportunity. POAH and POAH Communities, an affiliate of POAH, support residents through long-term partnerships, corporate sponsorship, and a focus on positive outcomes. POAH's corporate staff comprises 36% people of color and 54% women, POAH's Board is composed of 45% people of color and 50% women, and POAH Communities' staff is composed of 60% people of color and 59% women. POAH's development vision and management are rooted in a diverse organization, where racial equity and housing justice issues are vital.

Caste Capital is a Boston-based private equity firm serving as a socioeconomic catalyst through targeted investments in real assets and distinctive opportunities that significantly influence the built environment. Caste Capital specializes in responsible investing, concentrating on opportunities that deliver measurable societal benefits alongside risk-adjusted returns. In addition to managing their own accounts, they oversee equity co-investment vehicles for a diverse array of individual and institutional investors. Their strategy is designed to directly enhance the communities in which they operate, focusing on hiring and training the next generation of diverse talent, striving to create more inclusive opportunities for all.

The team is supported by a talented and diverse group of builders, designers, engineers, and other housing development professionals. The current Project team exceeds 50% M/WBE firm participation,

ensuring that the Project’s vision, planning, and long-term ownership are reflective of underrepresented entrepreneurs.

The design team is led by MASS Design Group, LTD (MASS) and The Architectural Team (TAT). MASS and TAT have built a strong working relationship while collaborating on POAH’s The Loop at Mattapan Station project. MASS will be the Design Architect and oversee the project’s conceptual and schematic design from proposal through the entitlement process, and TAT will support MASS during the entitlement process and once secured, will assume the role of the Architect of Record as design development begins. MASS is a mission-driven organization founded to support partners in delivering innovative capital projects that fundamentally improve lives and act as enablers for shared prosperity. Their work focuses on leveraging inclusive architecture and construction processes to create better health, justice, equity and long-term sustainability. TAT is driven by a commitment to exceptional design and an unyielding focus on achieving client objectives. TAT’s distinctive portfolio is a result of the firm’s respect for site, context and environmental sustainability.

A committed general contractor is critical to any local and diversity hiring program’s success. The Consigli-Smoot team is rooted in a mission to provide opportunities to Boston residents and minority and women-owned businesses as well as minority and female workers. They are committed to more than just transitory metrics – the Consigli-Smoot team wants to reshape the contracting industry in Boston and create a sustainable ecosystem of contracting careers for people of color and MBEs. This philosophy will be a driving force for the West End project, from selection through completion. Consigli-Smoot will fulfill this mission by making sure minority inclusion is both in the ownership of contracting and represented in boots-on-the-ground labor. Consigli-Smoot will require the same commitment from all subcontractors to provide Boston residents and people of color with priority for employment opportunities whenever subcontractors make new hires.

A table summary of the team can be found below:

Participation of MBEs and WBEs in our team		
Organization	M/WBE	Division of Roles
Ownership (Joint Venture)		
Caste Capital	MBE	Community Strategy Diversification of Capital Stack
POAH		Financing Strategy Funding applications and LIHTC equity placement Property management and services
General Contractor		
Consigli		Prime contractor
Smoot	MBE	Supporting contractor
Owner's Project Manager		
Toney & Associates, Inc.	M/WBE	Oversee Construction
Structural Engineer		
Odeh	MBE	Lead structural design Engineer of record
Ikerd		Structural BIM consultant
Civil Engineer		
Nitsch Engineering	WBE	
Sustainable Design		
EnviENERGY	WBE	Lead sustainability consultant LEED Article 37 Project Admin Energy Modeling Massive Passive House work as CPHC
CLEAResult	WBE	Passive House, LEED Verifier
Landscape Architect		
G2 Collaborative	WBE	

### **DEI Strategies for Project Development Phases**

The Proponent is committed to working affirmatively to empower the diverse communities it serves, both through its development and construction activities, as well as its long-term property stewardship. The Proponent's commitment to diversity, equity and inclusion is a core component of its organizational mission and is a factor in all stages of development and operations.

### **Predevelopment**

The Proponent is dedicated to collaborating with local officials, community-based organizations, housing authorities, and funding partners to set, track, and achieve local hiring and contracting goals. We aim to surpass the City of Boston's goals for Boston residents, people of color, and women in our workforce, and provide equitable access to upwardly mobile careers to help close wealth and housing gaps in the



city. A key component of the Proponent’s strategy is partnerships with local community organizations that further these goals, such as Boston Public Library, Historic New England, West End Museum, Beacon Hill Civic, West End Civic, Massachusetts General Hospital, along with other abutters and public officials.

### **Construction**

Projects of this scale can create significant employment opportunities for residents, people of color, and women, from material procurement to the broad array of interior and exterior scopes that require both general and highly specialized construction trades. Successful participation plans start in the planning phases before designs are complete and require creativity in engagement, scope development, and construction methodologies. The strategies outlined below will be further developed through input from MOH, resident leaders, and community stakeholders including supplier and trade organizations, and will be jointly implemented with the Consigli-Smoot team.

A committed general contractor is critical to any local and diversity hiring program’s success. The Consigli-Smoot team is rooted in a mission to provide opportunities to Boston residents and minority and women-owned businesses as well as minority and female workers. They are committed to more than just transitory metrics – the Consigli-Smoot team wants to reshape the contracting industry in Boston and create a sustainable ecosystem of contracting careers for people of color and MBEs.

This philosophy will be a driving force for the West End project, from selection through completion. Consigli-Smoot will fulfill this mission by making sure minority inclusion is both in the ownership of contracting and represented in boots-on-the-ground labor. Consigli-Smoot will require the same commitment from all subcontractors to provide Boston residents and people.

### **Outreach and Engagement**

A successful hiring strategy that maximizes participation among residents, women and people of color is based on broad, sustained, and dedicated outreach and engagement with these communities.

We will work closely with the Consigli-Smoot team, along with MOH, to develop and initiate a community engagement and hiring campaign in partnership with BHA and community organizations. These strategies include: outreach to subcontractors known to have higher minority representation; offering free online OSHA classes to residents; and fostering connections with the community employment centers.

Both Consigli and Smoot have strong existing relationships with MBE, WBE, local subcontractors, and suppliers in the Boston region and will continue to utilize those connections throughout the pre-construction process. Consigli maintains a proprietary database called SubHub that contains information on all SDO and DCAMM certified M/WBE subcontractors.

Consigli contacts all DCAMM-certified MBE and WBE trade contractors, sending project information and following up to gauge interest. For all non-trade work, Consigli-Smoot works closely with Beverley Johnson, President of the Massachusetts Minority Contractors Association

(MMCA) and attends monthly MMCA meetings making their members aware of bidding opportunities. They work with public agencies such as the Massachusetts Supplier Diversity Office (SDO) and community-based organizations to assist in the distribution of project information and bid documents, and they use their SubHub database to distribute bid invitations and connect with a diverse pool of participants. Consigli's bid invitations make all potential bidders aware of a project's established M/WBE subcontractor participation and BRJP workforce goals. Bid notices will be posted via social media outlets, notices in local newspapers (Boston Globe, Bay State Banner, el Planeta), and through advocacy groups, such as the Black Economic Council of Massachusetts, Builder's Coalition of Color, and the Urban League. Bid notices will include the stated M/WBE/local participation goals along with key information on the project.

Construction documents will be made available at no cost in virtual and physical plan rooms through the City of Boston, Builder's Coalition of Color, and the Urban League. Outreach events and job fairs will be held at convenient times and locations – not only in the West End but also in Boston's more diverse communities where we have established long-term relationships. At a minimum, the Consigli Smoot team will hold outreach events in Mattapan, Dorchester, and Roxbury to maximize participation, including workshops focused on the contracting requirements (including minority, women, and local workforce participation, Davis-Bacon tracking and reporting, and other compliance and reporting procedures).

Lastly, Consigli-Smoot will develop a detailed procurement plan defining our subcontracting opportunities at the design development phase of the project. The strategy will take into consideration purchasing time, submittal approval, and delivery requirements that would best allow small, minority, and female-led contractors to participate in the project. Our plan will outline all the project-specific trade contractor and material supplier requirements well in advance, providing an opportunity for companies to participate. It is our goal to provide as much information as possible – including bid package documents such as material delivery instructions, project schedules, life safety requirements, and off-hour work activities – to best support the engagement of under-represented companies.

### **Operations**

POAH Communities, a wholly owned property management affiliate of POAH, will be providing property management services once the project is complete. Our commitment to diverse and equitable hiring goes beyond construction and extends to the long-term operational period after properties come online and the residents are welcomed home. We are committed to meeting workforce goals throughout the life of the property. Operating sites require regular maintenance and unit turnover services including landscaping, painting, HVAC repairs, etc. All are opportunities for MBE/WBE participation. Additional opportunities for local employment are available through the POAH Communities team. These positions provide on-the-job training for residents, and we bundle the experience with support services to mitigate barriers to career employment. Positions may include property management positions such as entry-level receptionist positions, assistant to higher-level property manager positions as well as property maintenance positions such as entry-level porter increasing to maintenance supervisor. We have a long track record of ensuring that development projects support opportunities for residents and

members of the surrounding community. We work closely with local governments, community-based organizations, and funding partners to set, track, and satisfy hiring and contracting goals. During the operating period, we continue to prioritize and track MBE/WBE participation at each property and routinely exceed requirements as established at the onset of the project.

## **Appendix K – West End Library Letter of Intent**

August 8, 2024

James Arthur Jemison II, Director  
Boston Planning Department  
One City Hall Square, Ninth Floor  
Boston, MA 02201

Re: **Letter of Intent to File Project Notification Form**  
**151 Cambridge Street, West End Library**

Dear Director Jemison:

In accordance with the Executive Order Relative to the Provision of Mitigation by Development Projects in Boston issued on October 10, 2000, as amended on April 3, 2001, Preservation of Affordable Housing, Inc. ("POAH") and Caste Capital, LLC ("Caste") hereby submit this Letter of Intent to file a Project Notification Form ("PNF") under Article 80B of the Boston Zoning Code (the "Code") for the West End Library Project, a proposed mixed-use development located at 151 Cambridge Street in the West End neighborhood of Boston (the "Project").

The site of the proposed Project consists of approximately 0.51 acres of land bounded by Cambridge Street to the south, property owned by Massachusetts General Hospital and utilized as part of the Charles River Plaza to the west and north, and property on which the Otis House Museum is located to the east (the "Project Site"). The Project Site currently includes the Boston Public Library West End Branch.

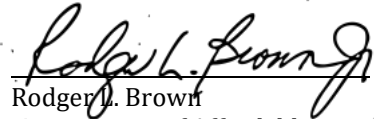
The Public Facilities Commission has designated POAH and Caste to redevelop the Project Site through an RFP process. In accordance with the RFP, the Project will demolish the existing library building and construct a new mixed-use building of approximately 186,000 square feet, comprised of a new two-story branch library and approximately 119 income-restricted rental residential units. The residential units will be available for families, seniors and individuals earning between 30-80% AMI, providing affordable housing in a place of opportunity and creating a vibrant community resource in the West End that will enjoy convenient access to nearby public transit, retail shops, and restaurants. The Project aims not only to provide low-income households with access to housing in a resource-rich neighborhood, but also for people of color and other marginalized groups to share in the benefits. A proposed robust resident services program will encourage residents to connect with each other and the community groups and resources of the West End, while the library design will provide spaces for residents, visitors, and community groups to meet, work, play, and read. Additionally, a proposed outdoor plaza between the library and neighboring Otis House will create a new neighborhood amenity and connection to cultural resources.

Consistent with the City's climate goals, the Project will employ CLT/hybrid construction and will include a Passive House component.

The Project Site is located within the Cambridge Street North Site Protection Area Zoning Subdistrict of the Cambridge Street North Zoning District, governed by Article 47A of the Code, as well as the Restricted Parking Overlay District and an Urban Renewal Overlay District. It is anticipated that the Project will require zoning relief from the following requirements: maximum Floor Area Ratio (FAR), maximum building height, maximum street wall height, and street wall setback.

We look forward to working with the Planning Department and continuing our engagement with the community throughout the Article 80 review process for this transformative Project. If you have any questions, please contact Rodger Brown at 617.449.0860, or Patrick Kimble at 857.939.3943.

Sincerely,



Rodger L. Brown  
Preservation of Affordable Housing  
Managing Director



Patrick Kimble  
Caste Capital, LLC  
Founder and Managing Partner

cc:     Beverley Johnson – Bevco, Inc.  
          Meena Jacob – POAH  
          Camille Platt – Planning Department  
          Joseph Backer – MOH



## **Appendix L – Letters of Support**

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December 17, 2024

Kairos Shen, Chief of Planning  
City of Boston Planning Department  
One City Hall, Ninth Floor  
Boston, MA 02201

Re: Letter of Support to File Project Notification Form  
151 Cambridge Street - West End Library Redevelopment

Dear Chief Shen,

Action for Boston Community Developments North End/West End Neighborhood Service Center is pleased to provide this letter of support for the proposed redevelopment of the West End Library at 151 Cambridge Street by Preservation of Affordable Housing, Inc. (POAH) and Caste Capital, LLC (Caste). Since being awarded the West End Library Project RFP in December 2023, I have had the opportunity to meet with the development team to review the proposed plans. The proposed plans will bring substantial affordable housing to the West End—a neighborhood rich in resources but suffers from lack of affordable housing. I believe these plans will contribute positively to the neighborhood and are an additive to the neighborhood.

The project features a 12-story residential building above a two-story library that will create 119 units of affordable housing, all below an 80% area median income (AMI). The development will offer housing opportunities to some of Boston's lowest-income families in a neighborhood with strong economic potential, close to transit, grocery stores, healthcare facilities, and other essential services.

The partnership between POAH and Caste combines the non-profit affordable housing mission with the deep knowledge of experienced local practitioners. Together, they introduce innovative ideas about diversifying the benefits of affordable housing development. The two organizations have assembled an exceptional team that can deliver on this vision and demonstrated tremendous commitment to the project by actively engaging with several site abutters, neighborhood groups, elected officials, and the City of Boston through a series of meetings.

The West End Library Project will not only deliver affordable housing but also revitalize a cherished community resource. The project's design and resident services will foster connections among residents, community groups, and local resources. The library will create a welcoming space where residents, visitors, and local organizations can gather, socialize, and participate in various activities. Additionally, the outdoor plaza and shared street between the Otis House and the library will serve as a valuable new neighborhood amenity that will help strengthen connections to nearby cultural resources.

We are excited to watch this development progress and the transformation this would bring to the West End neighborhood. I am confident in POAH and Caste's ability to deliver housing that is affordable and inclusive while enhancing the neighborhood's cultural and social landscape. We look forward to the future of our neighborhood with the delivery of this project.

Sincerely,  
Julia Power 

Director, ABCD North End/West End NSC

178 Tremont Street, Boston MA 02111 | P: 617.348.6000 | TTY: 617.423.9215 | F: 617.357.6041 | [bostonabcd.org](http://bostonabcd.org)

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*Neighbors  
Helping  
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December 18, 2024

Mr. Kairos Shen, Director  
Boston Planning Department  
One City Hall Square, 9th Floor  
Boston, MA 02201

Re: Letter of Support to File Project Notification Form  
151 Cambridge Street - West End Library Redevelopment

Dear Director Shen,

The Beacon Hill Civic Association (BHCA) is pleased to provide this letter of support for the proposed redevelopment of the West End Library at 151 Cambridge Street by Preservation of Affordable Housing, Inc. (POAH) and Caste Capital, LLC (Caste). Since being awarded the West End Library Project RFP in December 2023, we have had the opportunity to meet with the development team to review the proposed plans. We believe that the proposed plans will bring much-needed affordable housing to the West End—a neighborhood that, while rich in resources, suffers from a lack of affordable housing. These plans will contribute positively to the neighborhood and serve as a valuable addition to the neighborhood.

The West End Library Project will not only deliver affordable housing but will also revitalize a cherished community resource. The project's design and resident services will foster connections among residents, community groups, and local resources. The revitalized library will create a welcoming space where residents, visitors, and local organizations can gather, socialize, and participate in various activities. Additionally, the outdoor plaza and shared street between the Otis House and the library will serve as a valuable new neighborhood amenity, strengthening connections to nearby cultural resources.

The BHCA is excited to watch this development progress and appreciate the transformation this will bring to the West End neighborhood. We are confident in POAH and Caste's ability to deliver housing that is affordable and inclusive while enhancing the neighborhood's cultural and social landscape. We look forward to the future of our neighborhood with the delivery of this project.

Sincerely,

*Joshua A Leffler*

Joshua Leffler  
Chair

*Beacon Hill Civic Association - 74 Joy Street, Boston, MA 02114  
info@bhcivic.org - www.bhcivic.org - 617-227-1922*



Kairos Shen, Chief of Planning  
City of Boston Planning Department  
One City Hall, 9<sup>th</sup> Floor  
Boston, MA 02201

Dec 17, 2024

Re: Project Notification Form

The Greater Boston Food Bank is the largest hunger-relief organization in New England and among the largest food banks in the country. As part of our mission to make sure every person in need in Eastern Massachusetts receives three healthy meals per day, we partner with Preservation of Affordable Housing (POAH) at The Blackstone Apartments to provide monthly boxes of pantry staples and fresh produce to their residents. This program, called the Commodity Supplemental Food Program (CSFP) is a once-a-month food distribution for individuals 60 years of age or older.

Should POAH be selected to develop affordable housing at 151 Cambridge Street, we would be more than happy to explore how we could expand our partnership to improve food security for residents there.

Please feel free to contact me at [\[cperetti@gbfb.org\]](mailto:cperetti@gbfb.org) should you require additional information.

Sincerely,

*Christina Peretti*

Christina Peretti  
Sr. Director of Community Impact  
Greater Boston Food Bank

December 18, 2024

Kairos Shen, Chief of Planning  
City of Boston Planning Department  
One City Hall, Ninth Floor  
Boston, MA 02201

Re: Letter of Support to File Project Notification Form  
151 Cambridge Street - West End Library Redevelopment

Dear Chief Shen:

Historic New England is pleased to provide this letter of support for the proposed redevelopment of the West End Library at 151 Cambridge Street by the development team of Preservation of Affordable Housing, Inc. and Caste Capital, LLC. Since they were awarded the West End Library Project RFP in December 2023, we have had the opportunity to meet with the development team to review the proposed plans and discuss the possibility of a shared cultural campus and activated landscape between their property and ours, which has the potential to significantly enhance the vitality of the neighborhood.

Historic New England is the largest and most comprehensive independent preservation organization in the nation. Since our founding in 1910, Historic New England has played an important role in preserving Boston's historic architecture, including Otis House at 141 Cambridge Street, constructed in 1796, and two adjoining nineteenth-century row houses. This complex of buildings represents some of the last surviving architecture of the historic West End and, through its use as a house museum, provides important cultural and educational opportunities to the community and visitors to the area.

Historic New England is in the process of re-imagining the Otis House to revitalize and expand the visitor experience and civic purpose of the site, restore the historic architecture consistent with 21<sup>st</sup> century historic preservation best practices, and ensure that this landmark property remains a vital community asset for decades to come. To maximize collaboration and community-centered outcomes, we have coordinated and timed our design work to be in tandem with the redevelopment of the library parcel. We recognize this as a generational opportunity to unite the two sites through design and create a cultural campus with the Otis House and the library as anchors. It is also an opportunity to activate the shared landscape between us for the benefit of all the residents of the new tower, visitors to the cultural institutions, and the public. Our conversations with the development team have included their architect and landscape architect, as well as our own design team so we can collaborate and strategize about the opportunities and the challenges of the site.

One such challenge will be the prioritization of pedestrian visitors and residents to the shared campus while also considering the needs of service vehicles, loading and unloading for movers



and residential and library deliveries, and emergency vehicles. The development team has been responsive to this concern and to our thoughts on design changes to the building itself. We look forward to further conversations, in pursuit of solutions to unresolved elements of the project.

Historic New England continues to support the development team's work to redevelop the library parcel at 151 Cambridge Street. As a direct abutter, we have many concerns about the project and how it will affect the Otis House during and after construction, but we also see the incredible opportunity to address a housing issue in the West End that exists because of the destruction of West End housing during the mid-century urban renewal. We are committed to working with the development team to realize the full potential of this opportunity to create a cultural campus and landscape for the West End, returning much needed affordable housing and enhancing community benefits.

We are grateful for the partnership of both the City and the development team to date and look forward to next steps.

Sincerely,

A handwritten signature in black ink, appearing to read 'Vin Cipolla', with a stylized flourish at the end.

Vin Cipolla  
President and CEO

# Josh Zakim

10 Tremont Street Suite 201 Boston, MA 02108

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December 11, 2024

Kairos Shen, Chief of Planning  
City of Boston Planning Department  
One City Hall, Ninth Floor  
Boston, MA 02201

Re: Letter of Support 151 Cambridge Street - West End Library Redevelopment

Dear Chief Shen,

I am writing today in support of the proposed redevelopment of the West End Library at 151 Cambridge Street by Preservation of Affordable Housing, Inc. (POAH) and Caste Capital, LLC (Caste). As a current Beacon Hill resident and former City Councilor representing this neighborhood I am excited about the prospect of housing being built at this site. I have had the opportunity to meet with the development team to review their proposed plans which will bring substantial affordable housing to the West End—a neighborhood that certainly needs more affordable housing.

The project features a 12-story residential building above a two-story library that will create 119 units of affordable housing, all for residents earning 80% of the area median income (AMI) or less. The development will offer housing opportunities to middle and lower income Boston families in a neighborhood with strong economic potential, close to transit, grocery stores, healthcare facilities, and other essential services.

We are excited to watch this development progress and the transformation this would bring to the West End neighborhood. I am confident in POAH and Caste's ability to deliver housing that is affordable and inclusive while enhancing the neighborhood's cultural and social landscape. We look forward to the future of our neighborhood with the delivery of this project.

Sincerely,

Josh Zakim



Massachusetts Housing Finance Agency  
One Beacon Street Boston, MA 02108

Tel: 617-854-1000  
Fax: 617-854-1091

Relay 711  
[www.masshousing.com](http://www.masshousing.com)

December 11, 2024

Kairos Shen, Chief of Planning  
City of Boston Planning Department  
One City Hall, Ninth Floor  
Boston, MA 02201

Re: West End Library Redevelopment, Letter of Support to File Project Notification Form

Dear Mr. Shen:

I am writing to confirm MassHousing's strong interest in working with Preservation of Affordable Housing ("POAH") and Caste Capital, LLC ("Caste") on the financing for the redevelopment of Boston's West End Library. It is our understanding that POAH proposes to redevelop the current West End library into a new, expanded library with 119 units of affordable housing in a 12-story building.

MassHousing has been fortunate to work with POAH on a range of affordable housing projects in the past several years. Most recently, MassHousing has provided financing for Clarendon Hill Building E, the first phase of a state public housing redevelopment effort in Somerville, and the Kenzi at Bartlett Station, a new construction building in Roxbury that will meet Passive House certification and be a welcome addition to this Boston neighborhood. MassHousing has also worked with POAH on recent transformative developments in Mattapan (The Loop) and Roxbury (Flat 9). We feel the mission alignment and expertise of the POAH and Caste team will lead to the successful development of a community housing asset in Boston that will remain affordable and promote equity. We also know that since being awarded the West End Library RFP in December 2023, POAH and Caste have worked closely with site abutters, neighborhood groups, elected officials, and other stakeholders to ensure that the development meets the needs of Boston's most vulnerable residents and the surrounding community.

With respect to assisting with project financing, MassHousing offers a variety of options to finance mixed-income housing developments. Subject to the approval of EOHLC and the availability of volume cap, MassHousing offers tax-exempt construction and/or permanent financing to be used in conjunction with 4% Low-Income Housing Tax Credits. MassHousing

Maura Healey, Governor  
Kim Driscoll, Lt. Governor

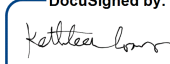
Jeanne Pinado, Chair  
Carolina Avellaneda, Vice Chair

Chrystal Kornegay,  
Chief Executive Officer

also offers taxable construction and permanent financing, which can be utilized in conjunction with 9% Low-Income Housing Tax Credits.

We look forward to collaborating once again with POAH to structure a financing package that best meets the needs of this property, subject, of course, to availability of funds, MassHousing's underwriting, and Board approval. Please feel free to contact me if you have any questions about MassHousing's financing on any of our previous successful development partnerships with POAH.

Sincerely,

DocuSigned by:  
  
C0C8C91391D94AD...

Kathleen Evans

Senior Director of Capital Deployment

cc: William Dunn, Senior Origination Manager  
Sarah Hall, Originator

December 20, 2024  
Kairos Shen  
Chief of Planning  
Boston Planning Department  
One City Hall Square, 9th Floor  
Boston, MA 02201

Re: Letter of Support to File Project Notification Form  
151 Cambridge Street - West End Library Redevelopment

Dear Chief Shen,

Mass General Brigham, of which Mass General Hospital is a founding member, is pleased to provide this letter of support for the proposed redevelopment of the West End Library at 151 Cambridge Street by Preservation of Affordable Housing, Inc. (POAH) and Caste Capital, LLC (Caste). Since being awarded the West End Library Project RFP in December 2023, I have had the opportunity to meet with the development team to review the proposed plans. The proposed plans will bring substantial affordable housing to the West End—a neighborhood rich in resources, but suffering from lack of affordable housing. I believe these plans are a positive and welcome addition to the neighborhood.

At Mass General Brigham we know the evidence is clear: stable, affordable housing is essential for good health, as poor housing conditions are closely linked to chronic issues such as cardiovascular disease, asthma, and long-term stress, and we are committed to addressing this key determinant of optimal health. In 2024, we announced \$18M in funding for affordable housing initiative through our [Community Health Impact Funds](#) to support 22 local organizations, including \$2.5M to support Mayor Wu's Boston Acquisition Fund to preserve affordable housing and combat displacement.

Partnership with trusted local organizations is key to addressing the root causes of health inequities to make measurable, sustainable impact, and the redevelopment of the West End Library to create 119 units of affordable housing, all below an 80% area median income (AMI) is well aligned with our goals. The development will offer housing opportunities to some of Boston's lowest-income families in a neighborhood with strong economic potential, close to transit, grocery stores, healthcare facilities including Mass General Hospital, and other essential services. We look forward to welcoming these residents to our community and caring for their healthcare needs.

The partnership between POAH and Caste combines the non-profit affordable housing mission with the deep knowledge of experienced local practitioners. Together, they introduce innovative ideas about diversifying the benefits of affordable housing development. The two organizations have assembled an exceptional team that can deliver on this vision and demonstrated tremendous commitment to the project by actively engaging with several site abutters, neighborhood groups, elected officials, and the City of Boston through a series of meetings.

The West End Library Project will not only deliver affordable housing but also revitalize a cherished community resource. The project's design and resident services will foster connections among residents,

community groups, and local resources. The library will create a welcoming space where residents, visitors, and local organizations can gather, socialize, and participate in various activities. Additionally, the outdoor plaza and shared street between the Otis House and the library will serve as a valuable new neighborhood amenity that will help strengthen connections to nearby cultural resources.

We are excited to watch this development progress and the transformation this would bring to the West End neighborhood. I am confident in POAH and Caste's ability to deliver housing that is affordable and inclusive while enhancing the neighborhood's cultural and social landscape. We look forward to the future of our neighborhood with the delivery of this project.

Sincerely,

A handwritten signature in black ink, appearing to read 'Nick Haney', with a stylized flourish extending from the end.

Nick Haney  
Public Coordination & Initiatives Director  
Mass General Hospital





W E C A

## WEST END CIVIC ASSOCIATION

Committed to protect and enhance the quality of life in the West End

December 19, 2024

Kairos Shen, Chief of Planning  
City of Boston Planning Department  
One City Hall, Ninth Floor  
Boston, MA 02201

Re: Letter of Support to File Project Notification Form (PNF)  
151 Cambridge Street - West End Library Redevelopment

Dear Chief Shen,

The West End Civic Association (WECA) is pleased to provide this letter of support for the proposed redevelopment of the West End Library at 151 Cambridge Street by Preservation of Affordable Housing, Inc. (POAH) and Caste Capital, LLC (Caste). Since the development team was awarded the West End Library Project RFP in December 2023, the WECA Zoning & Planning Committee has had the opportunity to meet with them to review the proposed plans. These plans will bring substantial affordable housing to the West End—a neighborhood rich in resources, but one that suffers from lack of affordable housing. We believe these plans will contribute positively to the neighborhood.

The project features a 12-story residential building above a two-story library that will create 119 units of affordable housing, all below an 80% area median income (AMI). The development will offer housing opportunities to some of Boston's lowest-income families in a neighborhood with strong economic potential, close to transit, grocery stores, healthcare facilities, and other essential services.

The partnership between POAH and Caste combines the non-profit affordable housing mission with the deep knowledge of experienced local practitioners. Together, they introduce innovative ideas about diversifying the benefits of affordable housing development. The two organizations have assembled an exceptional team that can deliver on this vision and that has demonstrated tremendous commitment to the project by actively engaging with several site abutters, neighborhood groups, elected officials, and the City of Boston through a series of meetings.



W E C A

## WEST END CIVIC ASSOCIATION

Committed to protect and enhance the quality of life in the West End

The West End Library Project will not only deliver affordable housing but also revitalize a cherished community resource. The project's design and resident services will foster connections among residents, community groups, and local resources. The library will create a welcoming space where residents, visitors, and local organizations can gather, socialize, and participate in various activities. Additionally, the outdoor plaza and shared street between the Otis House and the library will serve as a valuable new neighborhood amenity that will help strengthen connections to nearby cultural resources.

We are excited to watch this development progress and to see the transformation it will bring to the West End neighborhood. We are confident in POAH and Caste's ability to deliver housing that is affordable and inclusive while enhancing the neighborhood's cultural and social landscape. We look forward to the future of our neighborhood with the delivery of this project.

Sincerely,

*Carol Matyka*

Carol Matyka  
President-Elect  
West End Civic Association  
2 Hawthorne Pl #3L  
Boston MA 02114  
617 794 9570